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ABSTRACT

Presented are the proceedings of a national conference of the Professional Association for Computing and Information Technology, formerly known as the College and University Systems Exchange (CAUSE). Papers are organized according to the conference's eight concurrent tracks in the areas of policy and planning, managing technologies integration, financial impact and considerations, organizational and personnel issues, impact of departmental computing, outstanding applications, hardware/software/networking strategies, and academic computing strategy. Current issues sessions, constituent group meetings, and a "Writing for CAUSE/EFFECT" seminar are summarized, along with corporate participation. The 56 track papers are preceded by two general session presentations: the keynote address, "Managing Tomorrow's University" (J. Wyatt) and "Transforming Information into Knowledge--The Challenge for the 21st Century" (J. Sculley). Appended are descriptions of some of the contributions of 45 participating corporations as well as a section showing pictorial highlights of the conference. (SM)

Information Technology: Making It All Fit

Proceedings of the
1988 CAUSE National Conference

November 29 - December 2, 1988
The Opryland Hotel
Nashville, Tennessee

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CAUSE, the Professional Association for Computing and Information Technology in Higher Education, helps colleges and universities strengthen and improve their computing, communications, and information services, both academic and administrative. The association also helps individual members develop as professionals in the field of higher education computing and information technology.

Formerly known as the College And University Systems Exchange, CAUSE was organized as a volunteer association in 1962 and incorporated in 1971 with twenty-five charter member institutions. In the same year the CAUSE National Office opened in Boulder, Colorado, with a professional staff to serve the membership. Today the association serves more than 2,100 member representatives from over 800 campuses representing over 525 colleges and universities, and 39 corporate members.

CAUSE provides member institutions with many services to increase the effectiveness of their computing environments, including: the Administrative Systems Query (ASQ) Service, which provides to members information about typical computing practices among peer institutions from a data base of member institution profiles; the CAUSE Exchange Library, a clearinghouse for documents and systems descriptions made available by members through CAUSE; association publications, including a bi-monthly newsletter, *CAUSE Information*, the professional magazine, *CAUSE/EFFECT*, and a monograph and professional papers series; workshops and seminars; and the CAUSE National Conference.

We encourage you to use CAUSE to support your own efforts to strengthen your institution's management and educational capabilities through the effective use of computing and information technology.

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INTRODUCTION

As professionals in the field of information systems, we have a responsibility to our institutions to make the right information technology choices to best support decision making. The complexities of higher education institutions and of technology choices make this a challenge, but also offer an opportunity to strategically help our institutions.

Alan Kantrow recognized this several years ago when he wrote in a *Harvard Business Review* article, "The past decade reveals managers' growing awareness of the need to incorporate technological issues within strategic decision making. They have increasingly discovered that technology and strategy are inseparable."

A key aspect of this challenge and opportunity is how we can effectively integrate information technology within the framework of institutional objectives—how we can "Make It All Fit!"

In preparing for CAUSE88, the Program Committee and National Office staff developed an outstanding program to address the theme of "Information Technology, Making It All Fit" through

- presentations in eight professional tracks including, for the first time, an academic computing strategy track, coordinated by EDUCOM
- general session presentations by Joe B. Wyatt, Chancellor of Vanderbilt University, and John Sculley, Chairman and CEO of Apple Computer, Inc.
- participation by 45 corporations, including presentations, sponsored activities, hospitality suites, and—for the first time—a special corporate demonstration area
- a Current Issues Forum which brought together a panel of three administrators experienced in a range of organizational solutions for managing information technology, addressing the question, "Can It All Fit?"

Three pre-conference seminars on Tuesday, co-sponsored by CAUSE and EDUCOM, addressed issues important to conference attendees—campus networking strategies, administrative computing strategies, and strategic planning for campus computing and communications technology.

Other highlights of CAUSE88:

- a HyperCard-based messaging system developed by Apple Computer and HyperPro, using Macintosh SEs as information kiosks and digitized images of registrants for easy identification
- a daily conference newsletter, the *Daily Chat*, sponsored by Apple and Kinko's
- a cruise down the Cumberland River on the General Jackson riverboat, sponsored by Digital for Tuesday evening's welcome reception
- Opryland's beautifully-choreographed musical spectacular, "A Country Christmas Special," sponsored by IBM for Thursday evening's entertainment
- extensive discussion of a proposed merger between CAUSE and EDUCOM
- Digital's major announcement of its new, comprehensive Education Initiative during a continental breakfast which Digital held for all conferees

By all indications, this was one of the finest in the history of CAUSE national conferences. More than 950 people participated, 25 percent more than last year's record-breaking attendance. Evaluation forms reflected almost unanimous enthusiasm for the event, with special comments on the benefits of meeting with such knowledgeable, friendly professional colleagues. And there was clear evidence of a high level of interest in the association and its activities—the standing-room-only New Member Breakfast, a *Writing for CAUSE/EFFECT* seminar that drew 50 people late Thursday afternoon, and dozens of requests for ASQ reports and other information that followed staff back to the CAUSE National Office. It was a great pleasure for me to have been part of this exciting effort.

This publication of the substance of CAUSE88 should be a valuable continuing resource throughout the year, both for conference-goers and for those who will be reading about the conference offerings for the first time.

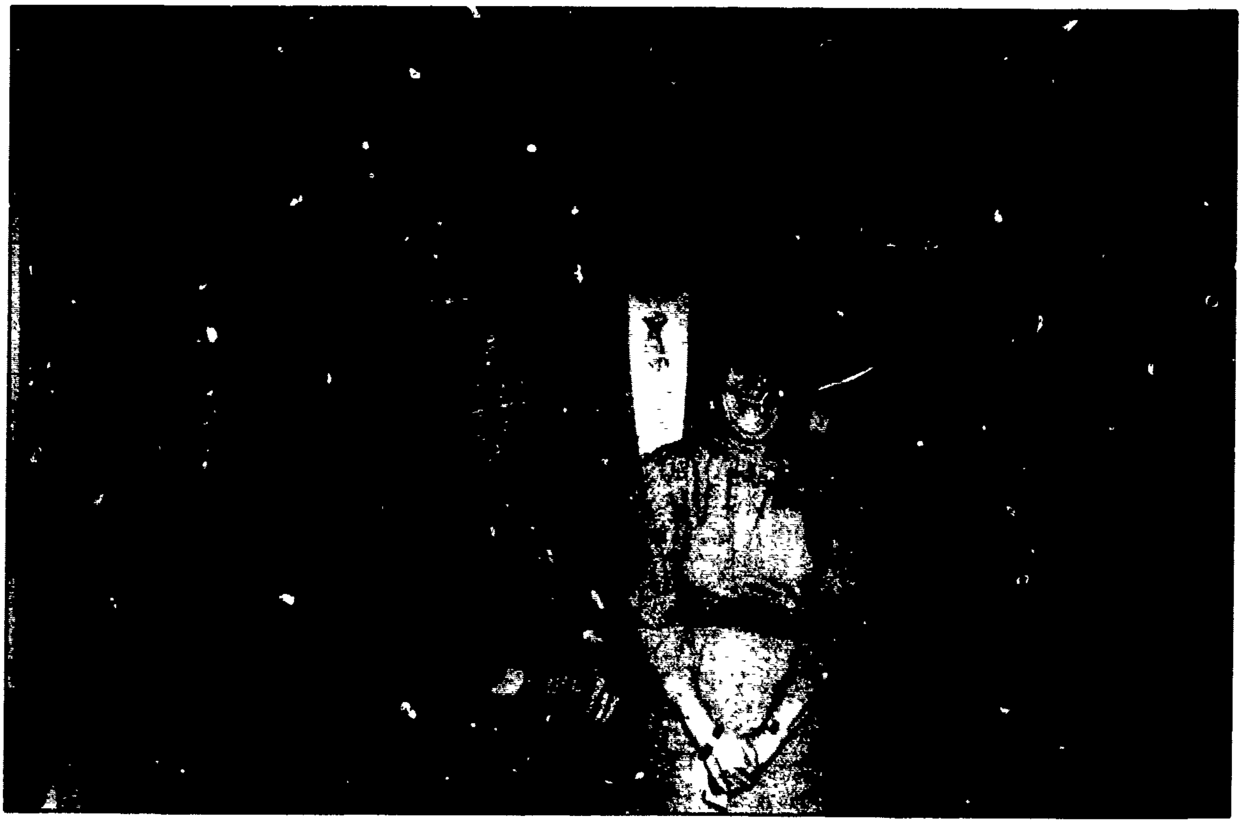
James L. Strom
CAUSE88 Chair

ACKNOWLEDGMENTS

The success of the CAUSE National Conference is due to the contributions of many people and supporting organizations, several of whom deserve special attention:

* The CAUSE88 Program Committee

This committee, under the chairmanship of James L. Strom and vice chairmanship of Martha A. Fields, spent many hours working with the CAUSE staff to produce an outstanding conference. CAUSE gratefully acknowledges their enthusiasm, time, and efforts, and the generous support of their institutions.



Front row, left to right: Deborah K. Smith, CAUSE; Milly Koss, Harvard University. Second Row: Renee Woodten Frost, University of Michigan; Betty M. Laster, Winthrop College; Albert L. LeDuc, Miami-Dade Community College; Martha A. Fields, State University System of Florida; Dorothy Hopkin, Oakland Community College. Third Row: Daniel A. Updegrove, EDUCOM; James L. Strom, California Polytechnic State University; Diane J. Kent, University of British Columbia; Barry Kaufman, City University of New York; Gerald P. Weitz, Stanford University Medical School. Not shown: George A. Carroll, Rutgers University.

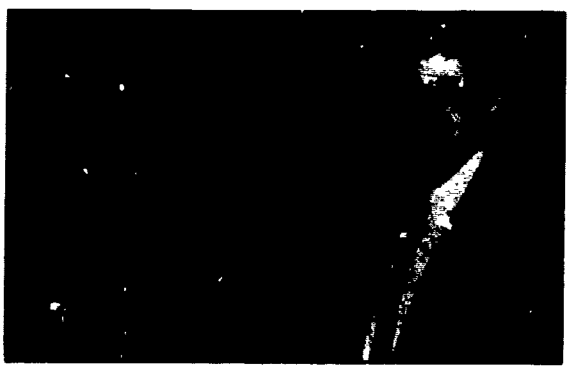
CAUSE88 Chair Jim Strom thanks Martha Fields for her help as vice chair. Fields will chair the 1989 CAUSE National Conference in San Diego.

* 1988 CAUSE Board of Directors

Front row, left to right: M. Lewis Temares, CAUSE Chair, University of Miami; Michael R. Zastrocky, Regis College; Carla T. Garnham, Medical College of Wisconsin; Robert C. Heterick, Jr., Virginia Tech. Back Row: Cedric S. Bennett, Past CAUSE Chair, Stanford University; Jeffrey W. Noyes, Mercer University; Jane N. Ryland, CAUSE President; David L. Smallen, CAUSE Vice Chair, Hamilton College; Bernard W. Gleason, Jr., CAUSE Secretary/Treasurer, Boston College; Thomas W. West, The California State University.

The generous contributions of time and creative energy of the CAUSE Board of Directors are gratefully acknowledged and appreciated.

Board members whose terms expired during CAUSE88 were Bernard W. Gleason, Jr., of Boston College, who served as secretary/treasurer in 1988; M. Lewis Temares of the University of Miami, retiring chair; and Thomas W. West of The California State University System. Temares will remain on the Board for one year in an ex-officio capacity as past chair. Cedric S. Bennett of Stanford University will serve the remaining year of the term held by Judith W. Leslie, who resigned from the Board in June after accepting a position with Information Associates.



Leaving the Board, left to right: Gleason, Leslie, and West

* CAUSE Member Committees

Neither the conference nor the other association activities could continue without the contributions of the six creative and active CAUSE Member Committees. CAUSE appreciates the time and energy contributed by the volunteers who carry out the duties of these committees.

At the Wednesday luncheon, CAUSE chair M. Lewis Temares thanked the many people who supported the association in 1988 through participation on association committees. Plaques containing certificates of appreciation were given to the following retiring committee members:

Current Issues Committee
George D. Alexander, Clemson University
Carole Barone, Syracuse University
George A. Carroll, Rutgers University
Ronald W. Jonas, Alamo Community College District

Editorial Committee
Rebecca Abbott, American University
J. Patrick Casey, Indiana University
Arthur J. Krumrey, Loyola University of Chicago
Joseph A. Middleton, Herbert H. Lehman College
Mark A. Olson, University of Southern California

Election Committee
Marion J. Ball, University of Maryland at Baltimore
Thomas W. Burtnett, Dickinson College
Joseph A. Catrambone, Loyola University of Chicago
Lawrence A. Fincher, University of Oregon
Kenneth G. Pollock, Wright State University

Recognition Committee
Dorothy Hopkin, Oakland Community College
Richard P. West, University of California System

Member Liaison Committee
Robert J. Agnew, Beaver College
Anita S. Better, Hunter College/CUNY
Thomas Gaylord, University of Alaska
David L. Harney, Milwaukee Area Technical College
Michael S. Jewett, Amherst College
Judah Rosenwald, San Francisco State University
James J. Scanlon, California State University/ San Bernardino

Program Committee
Martha Fields, State University System of Florida
Renee Woodten Frost, University of Michigan
Dorothy Hopkin, Oakland Community College
Barry Kaufman, City University of New York
Diane J. Kent, University of British Columbia
Adele M. Koss, Harvard University
Betty M. Laster, Winthrop College
Albert L. LeDuc, Miami-Dade Community College
Jim Strom, California Polytechnic State University
Daniel A. Updegrove, EDUCOM
Gerald P. Weitz, Stanford Medical School

* Contributing Vendors

CAUSE thanks all those vendors who set up exhibits, gave company presentations, and provided evenings of hospitality. Their contributions add an enormously valuable dimension to the conference experience.

Special thanks go to

Apple Computer for providing Macintosh SE computers and LaserWriter IINT printers for on-site registration needs and production of the conference *Daily CHAT*, for working with **Kinko's Academic Courseware Exchange** and **Kinko's Copies, Nashville**, to make the *CHAT* possible, and for developing and sponsoring the CAUSE88 Information Kiosks, with assistance from **HyperPro**; to

Digital Equipment Corporation for sponsoring the opening night Welcome Reception aboard the General Jackson riverboat and Wednesday morning's continental breakfast for all conferees; to

The IBM Corporation for sponsoring the Country Christmas Feast and Musical Revue; to

Information Associates for sponsoring the CAUSE Recognition Award; to

Systems & Computer Technology Corporation for sponsoring the *CAUSE/EFFECT* Contributor of the Year Award; and to

EDUTECH International, George Kaludis Associates, Inc., New Jersey Educational Computer Network, Inc., Peat Marwick Main & Co., and **Sun Microsystems, Inc.** for sponsoring refreshments in the CAUSE88 Hospitality Park.

GENERAL SESSIONS

CAUSE88 offered several opportunities for all conferees to convene in general sessions addressing topics of common interest.

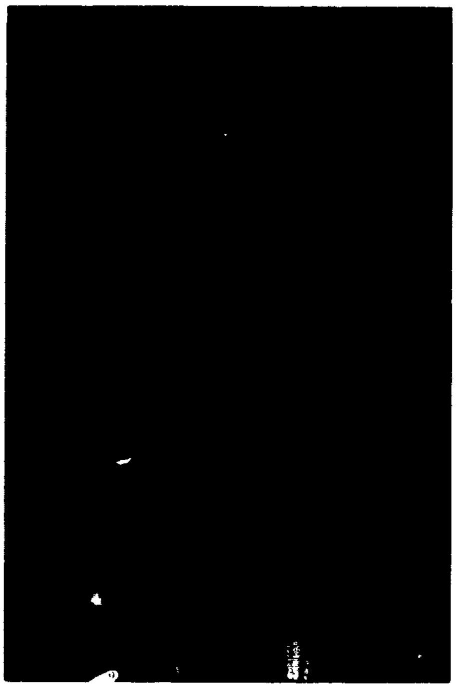
On Wednesday morning, Vanderbilt Chancellor Joe B. Wyatt officially opened the conference program with his descripti -f the complexities of university management, *"Managing Tomorrow's Un. ersity."*

Thursday morning's general session, broadcast live via satellite to 100 locations throughout the U.S., featured John Sculley, Chairman and CEO of Apple Computer, suggesting possibilities for *Transforming Information into Knowledge.*

Recipients of CAUSE awards were honored during the Wednesday Awards Luncheon, and recognition was given to members of the six association member committees and contributors to *CAUSE/EFFECT* magazine.

During the CAUSE Annual Business Meeting at Thursday's luncheon, new Board members and officers were introduced, winners of many corporate give-aways were announced, and a controversial vote was taken on the proposed merger between CAUSE and EDUCOM.

The final general sess'on of CAUSE88 was the Current Issues Forum, *Information Technology: Can It All Fit?*



"Managing Tomorrow's University"

Joe B. Wyatt

Chancellor, Vanderbilt University

Presented at CAUSE88
November 30, 1988
Opryland Hotel, Nashville

The topic I have chosen, "Managing Tomorrow's University," was a deliberate choice, designed to describe where we are today and provide a vision of the future. And, I suppose, it is my obligation to define when "tomorrow" is.

Depending on the decisions that are being made, tomorrow may be the next century—eleven years and one month away. Tomorrow may be the next decade—a year and one month away. Tomorrow may be next month, December, 1988.

For example, the decision Vanderbilt University just made to reaffirm, refinance, and invest $40 million over ten years in residential undergraduate student life will be played out in the next century. The debt service for this program will extend for 30 years, and we will not know whether the right decision was made until early in the 21st century.

Similarly, the outcome of a decision to host a research program in brain implantation of adrenal tissue to find a treatment protocol for Huntington's chorea and Parkinson's disease, at Vanderbilt Medical Center, will not be known for at least a decade.

The result of a decision to recommend a new baccalaureate program in music to the trustee budget committee next week will not be known until the end of the month and, of course, beyond that timeframe.

Each of these decisions—and many, many others—is part of managing tomorrow's university. It is obvious that to manage tomorrow's university we must have begun long before today.

Such is the continuum of decision-making at a university. Decisions are made each day. Some days require more decisions than others. Some are visionary, some are ordinary. Some are risky, some are safe. Some are progressive, some are damage controlled. All are necessary.

I see no need to explain to a group such as this the characteristics of a university from the viewpoint of a manager. It defies such a characterization anyway. No member of any university faculty feels a compelling need to be managed. Nor do students. Most people feel that they understand university management in any case. They've been in school a large part of their lives.

I would explain, however, some characteristics of the setting in which tomorrow's university will be managed by you, and all of us.

First, I believe it is the perception of a majority of the American people a their leaders that the quality of America's system of education at all levels is more important to the economic future and fundamental freedoms of America than ever before in its history.

Second, it is the perception of a majority of the American people and their leaders that America's system of education is in some degree of trouble. From a grade of F to a "gentlemen's C," but no better.

Within the past few weeks education in America has been the cover story of a host of national magazines, including Time, Fortune, and Business Week. For example, the sidebar of a Fortune article appearing November 7, 1988, was entitled, "Saving the Schools: How Business Can Help."

"The facts. Of the 3.8 million 18-year-old Americans in 1988, fully 700,000 had dropped out of school and another 700,000 could not read their high school

diplomas. Illiteracy among minority students is as high as 40 percent. By the year 2000, minorities will make up a majority of the school age population in ten states. In standardized tests between 1983 and 1986, American high school seniors came in last in biology among students from 13 countries, including Hungary and Singapore. They were eleventh in chemistry and ninth in physics."

"In all, 84 percent of the 23,000 people who took an exam for entry level job at New York Telephone in 1988 failed. Before a health clinic opened, 300 pregnancies occurred in a single year among the one thousand girls at a Chicago high school for the disabled."

The first recommendation from this Fortune article calls for us to restructure the whole system of American education. Other recommendations include: Support preschool programs. Lower the drop-out rate. Inspire the students. Promote job training. Raise college enrollments. Give parents a choice in the schools their children attend. And last, but certainly not least, recruit better teachers.

Indictments of our nation's schools have poured forth for five years now, beginning with "A Nation at Risk" in 1983, and supplemented by literally hundreds of studies and reports since. Editorials, Op-Ed pieces and feature stories on American education appear weekly and number in the hundreds. All of the members of Congress and all of the governors that I know, consider education to be an issue of the highest priority. Both presidential candidates pledged themselves to be "education presidents," in response both to their own judgements and the advice of their political confidants.

Last spring, former Secretary of Education, William Bennett, gave American schools an overall grade of no better than a C or C+. Earlier this month, a survey of its members by the Council on Competitiveness, a group of 156 chief executives of American business, labor and higher education, produced a report card for the competitiveness level of American business, labor, higher education, elementary, secondary education, Congress, the executive branch, state government and local government. The highest grade was a B+ for business. Higher education got a C+, only slightly better than the executive branch (with a C), and Congress which received a C-. The lowest grade went to elementary and secondary education, a D+.

All of the studies that I have read, and more besides, say that the most important single factor in the quality of our schools is the teacher. What do the teachers say about this crisis? To quote from *Time* of November 14, 1988:

"Over the years you're constantly bashed," says Cathy Daniels a Chicago English teacher. "You get it from the principal, you get it from the press. Bennett just topped it all. What particularly rankles is while accusations are flying, policies debated and remedies proposed, no one has consulted the real experts, those who do daily battle to improve the minds of students."

Says Ernest Boyer, president of the Carnegie Foundation for Advancement Teaching, "Whatever is wrong with America's public schools cannot be fixed without the help of those inside the classroom."

"In their own defense, teachers point out that their job has changed dramatically over the past 25 years. Increasingly they are asked not only to provide a good education, but also to address ever more complex and diverse social programs, drugs, sex, violence, broken homes, poverty. Today's classroom is a mirror of the crisis that affects the United States as a whole."

Roberta Wright has been a public school teacher for only three years. After receiving a degree in classical languages and years of "odd jobs and mothering", as she puts it, she returned to graduate school and earned a Masters degree in Early Childhood Education at the age of 39. She's a white kindergarten teacher in a predominantly black urban public school and she says, "It has turned out to be the perfect place for me." Listen to Roberta Wright's opening in her article titled: "Do I Make a Difference?".

"Here I am again. Day one. Kindergarten of Winn Elementary School in Austin Texas. As I look out on 15 little faces, 13 black and two white, I know that at this moment I'm the biggest thing in their lives. I am 'teacher', which translates into boss, mom, nurse, friend, comic, shoe-tie-er, moneylender, nosewiper, storyteller, magician and witch."

"For the next nine months I will be their personification of school. I will be, as well, what educators and parents, legislators and advertisers think a teacher should be. The pressure is on, even at my grade level, to teach reading and math, to raise sagging test scores, to teach children how to think, to inform them about AIDS and child abuse, to warn them against drugs and alcohol, to help them find meaning and self worth in a world brimming with violence and commercialism; to make public education work again."

As you may recall, the title of my talk is "Managing Tomorrow's University." Why do I describe the crises in America's elementary and secondary schools? Why do I quote a high school English teacher and a kindergarten teacher, too? Because we educated those teachers. We educated all their colleagues, and we'll educate their successors. Because their students today will be our students tomorrow. And because similar problems exist in our own colleges and universities. We only got a C+, remember?

In his 1987 book, "College, the Undergraduate Experience in America," Ernest Boyer chronicled the problems quite thoroughly. In even more complex ways, the expectations placed on Roberta Wright as a kindergarten teacher are placed on the faculties of America's colleges and universities: Beef up science and math instruction; improve expository writing and other communications skills. The list goes on, even extending to include Roberta Wright's kindergarten goals to teach children about AIDS and help them find meaning and self-worth in a world brimming with violence and commercialism.

Whatever the problems of American education, they begin in kindergarten, but they continue to our colleges and universities. We are a part of the education problem. And most importantly, we must be the source of solutions as a partner with government, business and the American people.

But that is not all. America's universities are also the primary source of basic research for the nation and the world. Research, discovery, and new knowledge developed from American university laboratories have fueled the development of new products and new treatments for dis-

ease throughout the world.

We know that we have problem in this area, too. Foreigners are winning a growing share of United States patents—last year, over 40,000 patents were awarded to foreigners, 46,000 to Americans. In 1975, the score was 51,000 for Americans and 25,000 for foreigners.

The real growth rate of research and development spending in America has declined continually from slightly over seven percent in 1980 to under two percent in 1987; it is projected to stay under two percent in 1988. The United States now trails both West Germany and Japan in expenditures for non-defense research and development as a percent of gross national product. The United States spent 1.85 percent. West Germany 2.5 percent. Japan 2.7 percent. And the trend for each of these important measures suggests further erosion of America's competitiveness in research and development.

I have described the two most important things we do in America's colleges a universities. First, to educate students, and educate tomorrow's teachers and professors in the process. Second, to do basic research. All of the management decisions we make relate to these things in one way or another.

Almost all public policy decisions, however, including those affecting American education at all levels, will be influenced by America's financial health. Yesterday in Washington, D.C., the Council on Competitiveness released a report entitled, "Reclaiming the American Dream. Fiscal Policies for a Competitive Nation." The report describes America's fiscal health in terms of several vital signs. Let me describe them:

Net National Savings as a Percent of Gross National Product. Net national savings in the United States has plummeted in the 1980s to about three percent of gross national product and is now less than one-fifth the average savings rate of major industrialized nations.

Net Domestic Investment as a Percent of Gross National Product. Because of national savings, net domestic investment needed to boost productivity and living standards has declined to 4.8 percent of gross national product, well below the level of the past three decades, which averaged seven percent.

Foreign Debt and Trade Deficits. Only significantly increased inflows of foreign capital—net foreign capital inflows of $155 billion in 1987 alone—has kept American investment levels as high as they are. The foreign debt is the mirror image of the nation's growing trade deficit.

Despite such deficit reduction efforts as the Gramm, Rudman, Hollings bill, federal deficit is projected to increase to $220 billion in 1993 without remedial action. Only when the Social Security trust fund surplus is included in the calculation does the deficit appear to be declining.

In this report, the Council makes several recommendations— with the strategy short-term reduction in the federal budget deficit, combined with a long-term plan to re-orient United States policy towards savings and investment. The recommendations contain short-run spending caps across the board, including defense and entitlements and propose increases in taxes across the board.

Finally, the recommendations propose a longer-term agenda designed to re-orient the nation away from consumption and towards productivity—enhancing investments, in what is called the "Building Blocks of Competitiveness": science and technology, and human resource development.

Yesterday's report is just the latest of many reports and recommendations that recognize the same problems but propose solutions that are couched in different terms such as increases in taxes. All of these solutions involve education. Federal support provides over 20 percent of American college and university expenditures first dominated by student aid, and next by research.

In total, education programs represent only about two percent of the federal budget. However, they represent about 14 percent of spending that is controllable.

Federal law and regulations affect colleges and universities in many other ways. Let me recite just a few items from an agenda of higher education issues that I recently received for consideration by the next Congress: tax law changes that affect charitable contributions, research and development tax credits, tax exempt bonds, unrelated business income tax, indirect cost of research, hazardous waste disposal, Medicare, Medicaid, use of animals in research, student aid. The list goes on.

Tomorrow is a time of crisis for education. It is a time of danger and opportunity for the management of education. Today's American university is one of the most complex organizations in our society and it is sensitive to the conditions of constituent elements in government, business, labor, and even other parts of education itself.

Managing the university well depends increasingly on the prompt availability of critical information in a form usable by decision-makers at various levels in the organization. The development of information systems in a university is a formidable undertaking, but is essential for development, planning and the decision-making environment.

Business organizations, particularly large American corporations, have devoted much attention in the past two decades to the development of comprehensive management information systems to support both planning and decision-making. Universities differ from their business counterparts in some important respects.

First, there is the problem of heterogeneous management styles. If there is single characteristic that labels a university as being different from almost any other enterprise, it's the diversity and idiosyncrasy of the management styles of university executives. Most chief executive officers of universities are drawn from the ranks of faculty. Humanists, lawyers, physicists and physicians, with a wide variety of administrative experience, run today's university.

The management styles among these executives range from very informal to very tight. And, accordingly, the decision-making style of these individuals ranges widely, particularly as it relates to decision support systems. Regardless of background and training, most university executives rely on a staff of information interpreters, people who supply information for decision-making, more than they do on computer-generated information.

A derivative issue involves the characteristics of individual planning style. Much of planning is a personal intellec-

tual activity. Universities, more than other institutions, are managed by the consensus of a large number of individuals who are very interested in the process of decision-making.

Organizational structure in universities varies widely, as well. In some cases, executive management functions through a concentrated organizational structure, with a president and a very small number of vice-presidents, functioning under the auspices of a small board of trustees. Other institutions have both a chancellor and a president, as well as a large number of vice-presidents, operating under the auspices of more than one board. This is particularly true in public institutions that characteristically have, in addition to a board of regents, both legislative and executive oversight committees from state government. And last, but not least, the political infrastructure at universities, both public and private, often affects decision-making substantially—from one institution to another, and from one time period to another.

Then, there is the problem of executive turnover. It is not unusual to find that the executives of an old and established corporation are long time employees. It is not atypical for a large corporation's management committee to be made up of five or six executives who have each been with the corporation for over 30 years. And, in fact, promotion up the corporate ladder from within is the rule, rather than the exception, for executive development.

Moreover, as an executive moves up the corporate ladder in a private corporation, generally he or she understudies the position for an extensive period of time, therefore becoming familiar with the role and scope of decision-making before assuming full responsibility.

This process is very seldom seen in most universities. University organizations are typically very flat, with less opportunity for promotion. For example, the dean of a small school in a university is unlikely to be promoted to the dean of a larger school in the same university. The tenure in office is relatively short. When Don Carroll was dean of the Sloan School at MIT, he conducted a study on deans, vice-presidents and presidents of universities, and found that the average tenure was less than five years.

Of course, there is the problem of the complex market structure. Large universities are complex organizations that operate in a complex marketplace. Individual university departments and schools have widely diverse interests and constituencies. If we consider students as the product of the university, the market is both simultaneously bleak in some fields and bullish in others. Due to organizational complexity, the lead time required to develop the capacity to produce students trained in a particular field, and the time required for students to matriculate in a new field, universities have significant difficulty in altering their output over the short term. It may take decades.

The faculty tenure system also limits the flexibility of universities to alt their product mix over a short period of time. More and more, however, universities are expected to react to short-term cycle phenomena by society.

Medical centers and research institutes appearing in many large universities add different complexities. In short, universities are faced with activities that require very long lead times to alter their fundamental function over decades, yet they are asked to survive in an economic system—in a marketplace—that is fickle from one year to the next, and growing more so.

These special characteristics must be recognized in any management system or planning model development activity that is done. In addition, there are a few rules I would add for any system development activity.

First, decision-makers who use management systems should be involved in their development. They must understand generally how the systems do what they do, or must employ a capable and trusted assistant who does—an interpreter.

One danger of the interpreter arrangement, however, is over-enthusiasm that can lead to the development of systems that are too complex...that provide information just in case the boss might ask. Such efforts can become very expensive.

Second, data must reflect the individual institutional situation at the highest level of aggregation possible. As yet, there is little if any standardization of data from one university to the next, however desirable that may be. In my opinion, it is very desirable. I challenge you to compare at any level of detail the data of one institution to the next, from their financial statement to any other representation. Moreover, the temptation to move to a finer level of data detail should generally be strenuously resisted in any system or planning model, in my view. Even with the best of intentions, systems can become overly complex and heavy with detail that is unwarranted and expensive to maintain. Planning models are particularly susceptible to this tendency.

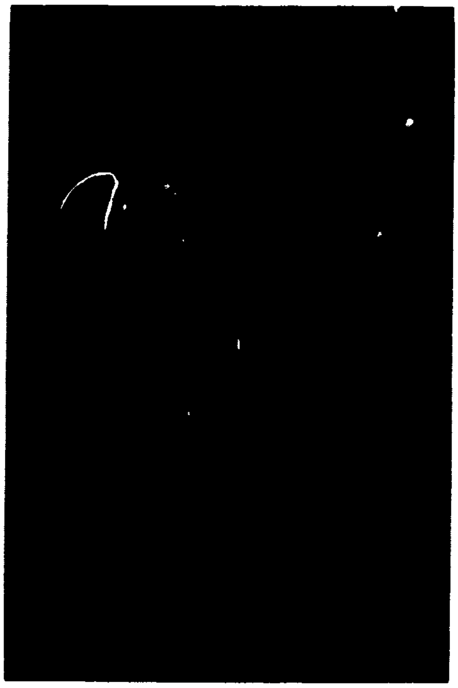
Third, systems must have executive mentors, leaders in the executive ranks—preferably including the chief executive officer, those who keep the system relevant to the decision-making and planning process on a day-to-day basis.

Fourth, systems should be friendly and understandable to their users. Keep user interface and the analytical methodology straightforward and understandable. The use of familiar information categories and familiar formats, even to the style of graphics or punctuation, can be critical.

Once the system has achieved a position of usefulness, there follows some enthusiasm to deal with more complex and difficult issues. In responding to this good outcome, avoid giant leaps of faith. Stick to the straightforward and understandable.

Finally, and perhaps most controversially, I believe all suggestions for the development of a comprehensive and all-purpose university-wide system should be considered with the skepticism normally reserved for the free lunch.

Large and comprehensive expert based management information systems have a very troubled track record. The track record for large and comprehensive planning models is even worse. Keep systems modular and reflective of the organizational structure in which they function.



"Transforming Information into Knowledge– The Challenge for the 21st Century"

John Sculley
Chairman & CEO, Apple Computer, Inc.

Presented at CAUSE88
December 1, 1988
Opryland Hotel, Nashville

Transforming information into knowledge is the key challenge that we face as we envision the university of the 21st century. What will the university of the 21st century look like?

I believe that we'll see institutions without walls. The university will become a borderless university, and in many ways that will set directions for, conceivably, borderless nations as we move further into the 21st century. All this will be caused by the tremendous revolution that is taking place through information technologies.

The network will become the organizational paradigm, replacing the hierarchical one that has been so familiar to us during the industrial age. Networks will lead to shared resources, meaning that we'll have libraries that can be shared by universities across the nation, if not across the world, and will also be able to share the works of individual scholars with many different campuses across our nation.

Learning, I believe, will become a lifelong experience, because—in the information society—we must expect that individuals will have four, maybe even five or six different careers during their working lifetime.

This rapid change we are experiencing will create not only new companies but new industries. So it will be important for people to continue the renewal process of learning. And it is important for all of us to be able to identify the kinds of people that are going to want to participate in this renewal process.

And I believe that we are going to see that the student population of the 21st century university will also dramatically change. It will allow us to have a geographically separated population because there will be communications over electronic networks that will allow the students to participate in the learning process.

I also believe that we'll see older students in the population as a by-product of the lifelong learning process. It is reasonable to expect that we'll see more part-time students, as people find that they may not even begin their college career until four or five years after they have graduated from high school.

All of these changes are going to require that we re-address the learning technologies that will be available in these 21st century universities.

We know that interactive learning systems are going to become an important new technology and they will probably incorporate multimedia technology. It is interesting to me that the technologies of the 21st century are already incubating today. They already have been discovered. They're already in the process of being evolved in our laboratories, in universities, in companies, in institutions around our nation.

Technologies like: Advanced user interface, multimedia, communications, intelligent agents as part of artificial intelligence, distributed processing, advanced simulation, and the miniaturization of the very hardware itself.

One of the things that I became curious about a few years ago was the way these technologies can converge in terms of a product Was there a way to show people what a product of the 21st century might look like? I wrote about this in a

book about a year and a half ago and described this product as the Knowledge Navigator. A videotape dramatization of the Knowledge Navigator provides a nice context to be able to look at what the future might hold in terms of the kinds of tools that will be available to the universities of the early 21st century.

While the Knowledge Navigator is not yet a product announcement, it's not science fiction either. We are interested in, and working on, every one of the technologies encompassed in the Knowledge Navigator. So, I believe that someday there will be a product that will resemble the Knowledge Navigator.

Looking back from the future to the present enables us to appreciate the tremendous paradigm shift that we have already undergone as we made the transition from the industrial economy that most of us have grown up with, to the information economy, which is global in scope. From a management standpoint, we see that the organization has shifted from the hierarchical model to the network model.

I see it in my own business, where we have tremendous interdependencies between companies that are not owned by us, but with whom we work closely. I think that this is becoming the case more and more often, as large corporations discover that size is no longer a strategic advantage.

If anything, size often reduces one's flexibility. Vertical integration, which was once a major goal for large manufacturing enterprises in the industrial age, is now questioned seriously as people realize that they can off-load those needs to other companies that are very good at focused activity.

We have also seen a shift, I believe, from the institution itself to the individuals inside the institution. We see that the style of organizations is becoming less structured and more flexible; that the source of strength which used to be defined as stability is now being defined as an ability to deal with change. And leadership, which was once perhaps characterized as the World War II fighter pilot model of the autocratic leader, is giving way to the leader who can inspire, rather than dictate through dogma.

Quality in our country used to be defined as the affordable best. What could we produce within the limits of the funding that we had in our budgets? We now realize that in a global economy, "affordable best" is not good enough. That we must have the ability to build the best quality with no compromises.

Expectations for employees in organizations used to be focused on security. People would join an enterprise expecting to be in that enterprise for perhaps their entire career lifetime. Now we don't really expect just security, we expect personal growth. And we ask people to make a commitment while they are part of the enterprise, recognizing it is realistic they will move on and perhaps work for several enterprises during their careers.

Even titles and ranks have changed as people put a greater emphasis on, "Is the individual making a difference?", rather than, "Where is their office? What's their title?" In the economy as a whole we have seen strategic resources shifting from those that are coming out of the ground, to those that come out of our head. To ideas and information.

Motivation is being focused—not just on how we compete for a larger share of the pie—where there are winners and losers—but how do we build? Perhaps one of the biggest characteristics of a global economy is that there doesn't have to be just one winner, but there can be several different winners. And if there are winners, others benefit that may not even be part of those most active economies.

These are some of the characteristics that I think we are seeing in the information economy. With the perspective of looking back from the future to the present, perhaps it is useful to look at information technology itself.

The first wave of computers were mainframe machines which were designed to do data processing. They were tremendous productivity machines that allowed us to do tasks much faster by systematizing work, and they fit into the model of the industrial age, where we tried to mechanize things and to build on the factory model.

Now, in the information age, we are going through a redefinition of productivity. As the performance of computers goes up, and the cost of that processing power comes down, we have not seen the corresponding increases in productivity that one would expect in recent years.

I believe that the focus now has to shift, not to the institution as a whole, but to empower the individuals inside the institutions. The real productivity gains in the information economy are going to come by getting individuals to change the way they do things, change the way they work.

The first revolution for personal computers could be defined in terms of making the computer accessible to individuals. The idea 15 years ago that people would have a computer of their own seemed not only outrageous, it seemed ridiculous. Yet, it is no longer questioned.

The second revolution of the personal computer, however, is just beginning. This revolution doesn't involve advances of technology to make it smaller and cheaper. This is the revolution that says we now must get the people to use the technology. I would suggest to you that getting people to use the technology is just as important as making technology accessible to them when personal computers first came out.

This is the context in which we should look at management and information computing within the university environment. The decisions that you are making today as managers are going to be the decisions that will shape the future of the early 21st century. No more important strategic management task is ahead of us than doing exactly that, because the real structure of the university of the 21st century will not be bricks and mortar. The real structure will be information systems.

I'd like to share with you just briefly some of my own experience at Apple. When I joined Apple, the company had just over $500 million in revenue. Today, five and a half years later, we have $4 billion in revenue, and we are headed towards, we believe, the possibility of reaching about $10 billion revenue in the early 1990s.

But size is not what motivates us.

We look at the way our enterprise can grow. And the way people inside the enterprise can grow as individuals. At the time that I joined Apple, it was largely a

projects organization. People worked in small teams, pretty much defining for themselves what they wanted to do. Out of that came some extremely brilliant work. As the organization became larger, it was very difficult to be able to adapt to the cyclical changes in the computer industry enough. So we redefined the organization in 1985 to a functional structure.

There is nothing particularly innovative about a functional organization, but it does give you greater control over process, and allows you to focus on various disciplines. In the case of a manufacturing company, there is a sales organization, a finance organization, a manufacturing organization, a research and development organization, and it's functionalized from the top all the way down to the lowest level.

As we reached our current size, we realized that a functional organization was no longer scaleable into the future; that we couldn't achieve a $10 billion or larger size as a functional organization because it forced too many of the decisions up to the top.

So we looked for a scaleable model, the result being that the scaleable model we discovered would require systemic changes in our enterprise. It required that we systemically look at the way we designed our products, all the way through manufacturing, and ultimately, to delivering them to the customer.

The new model also meant that we had to be able to build new capabilities into our enterprise, and systemically, so they became integrated. We put a high priority on customer satisfaction in building a global business with the necessary supportive infrastructure to make all of this effective.

I'd like to give you a perspective of some of the key issues that became important to us. In the Second Wave, as Alvin Toffler define our economics, the basic approach has been, "Tell people what they need to know." And really no more than that. Only tell them what they have to know, and if you do that they'll be able to do their jobs effectively.

What we are learning in the Third Wave, the information economy, is that any information should be made available to people that they could possibly be interested in. The accessibility of information is very important. Management shouldn't determine what will be accessible; the people, the users, should determine what they want to access.

The second perspective that I would like to share with you is that of an organization that will undergo constant change, as we've seen in our own industry. Apple has reorganized every year or two. The reason for that is that when a company is growing at 50 percent, there are totally different issues that have to be dealt with.

So, if we know there will be constant reorganizations, it is very difficult to take the old approach to information system planning, where the organization structure is identified, and then mapped on top of the organization structure are the information systems needs. If organizations are changing all the time, the information systems on top of that organization structure have to be remapped. The information systems design is constantly changing. That is not very efficient.

We have discovered that it is better to do exactly the reverse. You need to systemically understand what your enterprise is all about and where it is headed, and design the information system, looking at it as a network model, not a hierarchical one—in such a way that it can accommodate whatever organizational design that you may have.

So, in our case, most important to us is what we call the Apple database in the network system. On top of that, we have the ability to map a variety of different organization changes as they occur in the future.

Now let's shift from the global perspective down to the practicality of the tools with which we want to empower individuals.

We want to whet your appetite at this CAUSE conference with some of the tools that are available today, from simple things like Desktop Publishing—where a newsletter can be printed each day—to the kiosks in the lobby that allow you to share messages with one another.

I'd like to now talk about several information tools which are becoming more pervasive in campus computing environments. (Mr. Sculley then narrated demonstrations of the following three applications).

*•**NOTIS**, a commercially available library catalog system originally developed at Northwestern University. With the assistance of Rick Carmichael of Apple Computer, a new demonstration of NOTIS was conducted featuring a special development project with the Texas A&M Library. In this example, the new Texas A&M library system was demonstrated featuring HyperCard—a software development application and development tool—and Mitem, a program that handles communications and pattern matching with the host application.*

A book search was conducted to demonstrate the system's ease-of-use—including a library map highlighting the location of the book inside the library. The demonstration of the library system, prepared by Carmichael and Kelly Leeper of Texas A&M is just one of the components available on Texas A&M's campus information system.

*•**EXECUTIVE SUPPORT SYSTEM**, first developed by Information Associates to access mainframe data on MS-DOS-based computers. Two students from Cal Poly in San Luis Obispo, Michale Morgan—who assisted with the demonstration—and Darren Giles, wrote the macintosh front-end to the school's executive support system.*

The mainframe component of the program collects data from the school's primary database, and also from national and regional databases. The component developed at Cal Poly is a localized software application which retrieves data from the mainframe, stores it and then uses it to produce tables and graphs. Users can easily manipulate the data into meaningful information without having any working knowledge of a spreadsheet or graphics program.

*•**HYPER TV**, a demonstration by John Sculley utilizing the Macintosh IIx with a digitizing board, laser disk player and HyperCard tools. Using a HyperCard front-end created by Apple engineer, Steve Maller, video images with stereo-quality sound were accessed using simple point-and-click commands. Navigating across a video knowledge base,*

the user can access a multimedia creative learning experience.

I think Hyper TV is very exciting. The reason it is not just because this technology is neat to look at, but more importantly because the hidden cost in everything I have talked about, to get people to fundamentally change their behavior, is training. How do we train people to use technology?

Training is more than teaching trainers to go out and train people. Training is getting potential users interested in what they are going to learn—to be able to bring into the user's experience multimedia, so they can see text, hear sound and watch video. To be able to create tools that don't require many years of engineering time, but can be created with tools like HyperCard, that can be learned by people who have never done any other kind of programming before. This is one of the most important breakthroughs that we can bring to revolutionizing the ways that computers will be used as we head into the 1990s.

A thought I'd like to leave you with is that changing the behavior of users is going to be perhaps the single most important thing that any of us can do to leave a record, to build the roots for the kinds of university environments we want to see in the 21st century. This means that we must focus on users' solutions first, and that, in a multi-vendor world, we must be able to integrate into whatever we choose.

We want to emphasize in this exposition not just what the Macintosh can do by itself—that might be interesting—but more important, how well it integrates into the environment of other computers that you may have on your campuses. That is far more important within the paradigm of a network model.

Many of you know that between 80 and 85 percent of MIS budgets doesn't go to new technology; it goes to the maintenance of technology already in the installed base.

We hear the words today, "Open systems." Open systems only make sense in the context of being able to enhance, not to obsolete, the installed base investment that you have. We estimate that there may be some $200 billion of installed base investment that exists today, largely on mainframes. That investment should be enhanced.

One of the most interesting things about the technology that we have been looking at this morning is the ability to take it, using HyperCard and Macintosh, and to create a front-end to the installed base investment that is already there.

As you look at the changes in your campus environment, you must look at new ways of doing things. You must look at technology that is not only usable, but technology that is useful. From your perspective it shouldn't be, "One solution fits all cases," but it must provide customizable tools.

I believe one of the most important messages that we can bring to you is the message that Apple is focusing on tools that will allow you to create the kinds of things we have seen today, or to use our tools to create front-ends to the installed investment that you may already have.

In the process of doing all of this, we know we are not going to make fundamental changes in the way people use the technology unless it is made very, very appealing. The appealing part comes through in the way that the interface experience is received by the user.

The control panels, the multimedia, these things are important; and they aren't necessarily expensive to accomplish in either money or time.

The reason Apple Computer is so interested in CAUSE is that we have built a large following, particularly with students on your campuses, in the academic world. Now we want to try to build a large following in the administrative and management areas of the campus. We believe that we are ready to come to you with credible solutions that have a philosophy that ties very closely to the philosophies that many of you have as you begin to shape your university environments for the 21st century.

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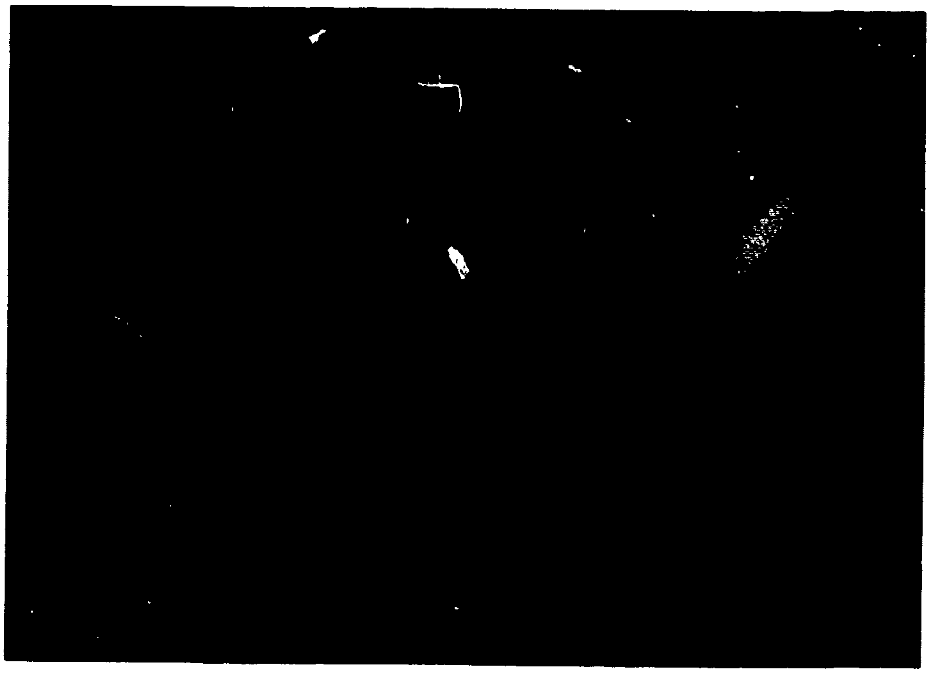
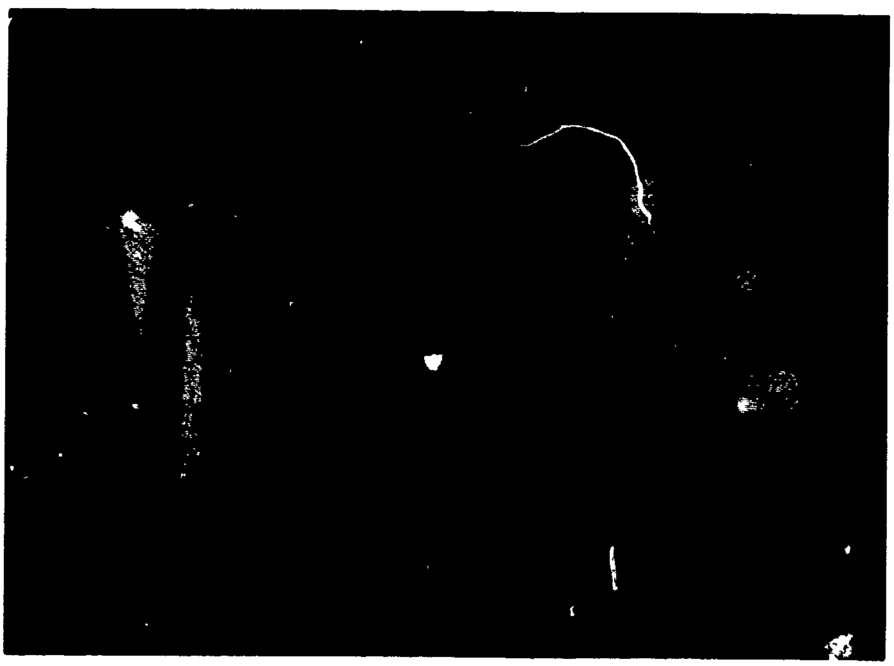
WEDNESDAY LUNCHEON

Award Presentations

Highlighting this luncheon were the presentations of the 1988 CAUSE Recognition Awards and the *CAUSE/EFFECT* Contributor of the Year Award, with special acknowledgment of award sponsors Information Associates and Systems & Computer Technology Corporation.



M. Lewis Temares (left), CAUSE Board Chair, and John Robinson (right), CEO of Information Associates, offer plaques and congratulations to Joseph A. Catrambone, Vice President for Information Systems at Loyola University. Catrambone was the 1988 winner of both of the awards presented by CAUSE annually for leadership at the institutional level and the national level. The awards have been sponsored by Information Associates since 1980.



The 1988 CAUSE/EFFECT Contributor of the Year Award went to Robert R. Blackmun, University of North Carolina/Charlotte; Jeff N. Hunter, North Carolina State University; and Anne S. Parker, University of North Carolina/Chapel Hill for their article "Organizational Strategies for End-User Computing Support," which appeared in the Fall 1988 issue. Systems and Computer Technology Corporation has sponsored the award since 1982.

Pictured are Hunter; CAUSE Chair M. Lewis Temares; Michael J. Emmi, Chairman and CEO of SCT; and Blackmun.

WEDNESDAY LUNCHEON
Committee Recognition

(Above) Board Chair Lew Temares acknowledges the enormous effort expended by CAUSE88 Chair Jim Strom.

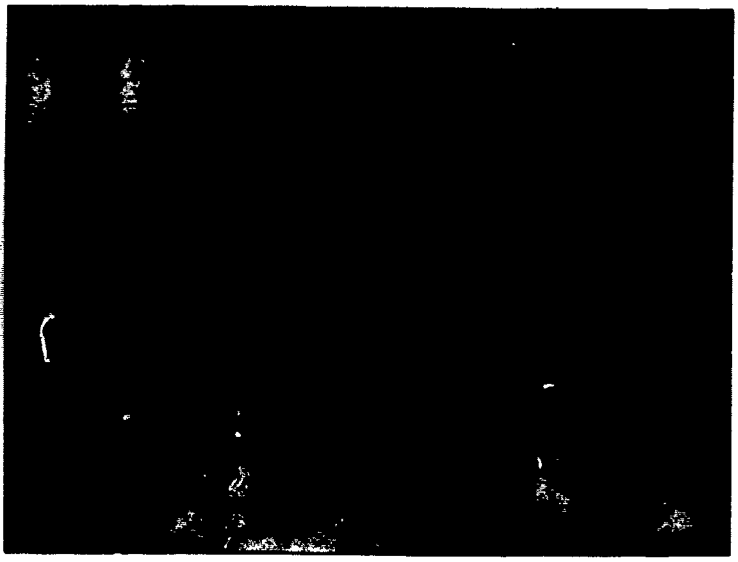
(Left) Retiring Editorial Committee members receive thanks for dedicated service.

THURSDAY LUNCHEON
Introduction of 1989 CAUSE Board

(Above) Outgoing Chair Lew Temares passes the gavel to new Chair David L. Smallen of Hamilton College.

(Above right) Lew Temares at lower right with new Board Chair Dave Smallen. Behind them are Secretary/Treasurer Michael R. Zastrocky (Regis College) and Vice Chair Robert C. Heterick, Jr. (Virginia Tech).

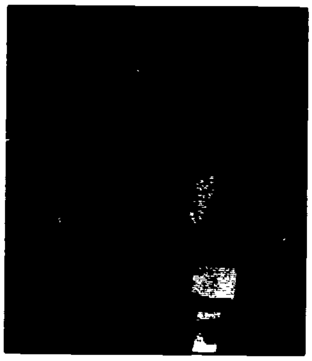
(Below right) New Board members Carole Barone, Syracuse University; Arthur J. Krumrey, Loyola University of Chicago; and A. Jerome York, University of Cincinnati.



FRIDAY GENERAL SESSION
CURRENT ISSUES FORUM

Information Technology: Can It All Fit?

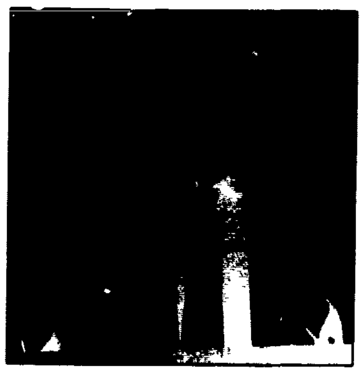
George A. Carroll, Director of the Center for Computer and Management Services at Rutgers University and chair of the 1988 CAUSE Current Issues Committee, moderated this concluding session of CAUSE88. The session was a panel discussion presenting a range of organizational solutions for managing information technology in higher education.



Paige Mulhollan, President of Wright State University, took the highly-centralized management view—an IRM organization exists at Wright State, and a CIO is in place.

Thomas West, Assistant Vice Chancellor for Computing and Communications Resources for The California State University System, discussed how institutions come to select particular ways of organizing for IRM.

Robert Scott, Vice President of Finance at Harvard University, described a successful decentralized model.



PROFESSIONAL PROGRAM

The CAUSE88 theme, **"Information Technology: Making It All Fit,"** was addressed through fifty-five professional presentations in eight subject tracks, as well as through many other professional development opportunities. Eight Current Issues Sessions were scheduled to allow conferees to converse about topics of special interest. Nine Constituent Groups met to exchange information and experiences pertaining to specific working environments. A very well-received new seminar, "Writing for *CAUSE/EFFECT*," was offered twice during the conference.

Printed in the following pages are summaries of the Current Issues Sessions and Constituent Group meetings, information about "Writing for *CAUSE/EFFECT*," and papers from the professional presentations categorized according to the eight conference tracks.

CAUSE gratefully acknowledges those individuals who agreed to present papers on a moment's notice. Although they were not called on to present, their papers are included in these Proceedings.

Current Issues Sessions

Eight scheduled Current Issues Sessions provided informal opportunities for conferees to meet and exchange ideas on topics of special interest or concern. The topics were chosen from issues which have been of interest to the profession in the past year.

AI/Expert Systems and CASE: What's on the Horizon
Moderator: Dorothy Hopkin, Oakland Community College, with Fred Forman, American Management Systems
Don Oxley, Texas Instruments

Allocating Resources for Computing and Evaluating How We Are Doing
Moderators: David Smallen, Hamilton College
Michael Dolence, Cal State/Los Angeles

CD-ROMs: What Is Their Place in Education?
Moderator: Jim Gorham, Harris-Stowe State College

Computing Service Centers and Libraries: Fit or Misfit?
Moderators: David Walch, California Polytechnic State University
Anne Woodsworth, University of Pittsburgh

End-User Computing: The Major Issues
Moderator: Carole Barone, Syracuse University

Industrial Partnerships: Are They for You?
Moderators: Len Brush, Carnegie Mellon University
Art Gloster, California Polytechnic State University

Relational Technology: Do You Need It?
Moderator: Becky King, Baylor University

Where Will FAX Fit In?
Moderator: Jerry York, University of Cincinnati

AI/Expert Systems and CASE: What's on the Horizon?

CAUSE88 Current Issues Session

Moderated by Dorothy Hopkin, Oakland Community College
with
Fred Forman, American Management Systems, and
Don Oxley, Texas Instruments

An overflow crowd met during this session to talk about the relevance of artificial intelligence/expert systems and computer-assisted systems engineering tools for higher education computing planners and administrators. The group was very heterogeneous, representing all levels of administration, and discussion ranged from implementation questions ("how do we do it") to philosophy ("should we do it") to predictions for the future.

It became fairly clear during the discussion that the term "expert systems" should disappear in the near future, because it simply means taking the implementation of systems to the next level—that of "programming" the mind process.

Fred Forman of American Management Systems and Don Oxley from Texas Instruments were on hand to answer research-related questions. Both were positive about their companies' efforts, but did not underestimate the amount of work and research that will be necessary to improve these kinds of systems in the future. Session participants also took this opportunity to ask specific questions about AMS and TI products and plans.

Current Issues Session

Allocating Resources for Computing and Evaluating How We Are Doing

Wednesday, November 30th (23 people in attendance)

Moderators: **Michael Dolence**, California State University/Los Angeles
David L. Smallen, Hamilton College

The role of computer professionals as advocates for technology investments was introduced. Advocacy was advanced as a concept that avoids defensiveness, integrates the justification activity into strategic thinking, engages resource providers in the solution process, and grounds resource requests in the fundamental purposes of the institution. At the other end of the spectrum, ways of assessing the effectiveness of the use of information technology resources was discussed as a means of self study and as part of the accreditation process. The *CAUSE/EDUCOM Guidelines for Information Technology Resources* were used as an example of a tool that could be used for self-assessment.

A number of advocacy tools were discussed including the course-by-course approach used at California State University/Los Angeles, and the special interest group approach which encouraged heavy users to document their needs. Several institutions indicated that the justification process often boiled down to a comparison with peer institutions.

Several of the institutions indicated that they have used a technique of depreciating equipment to deal with the problem of planning for hardware/software replacement. Another suggested approach involved building an endowed fund for information technology investments. Such approaches helped to provide for continuity in the information technology environment.

Several methods of evaluating services were explained. Included were monthly surveys of users, analysis of strengths and weaknesses, subjective focus groups, and evaluation by outside advisory groups. Several institutions indicated that they used approaches of collecting evaluations from users and sharing the results with the general college community. Chargeback schemes were also discussed as a way for users to provide feedback on computer services performance. This approach puts the computer services organization in the position of actively selling services to its users.

Attendees found that the *CAUSE/EDUCOM Guidelines* provided a useful set of questions for institutional self-evaluation. However, it was felt that senior administrators still wanted to see data from peer institutions rather than develop institution specific-criteria for evaluation.

CURRENT ISSUES SESSION SUMMARY

CD-ROMs: What Is Their Place in Education?

Moderated by
Jim Gorham
Harris-Stowe State College

The CD-ROM Current Issues Session focused on choices faced by computing centers providing services to libraries, retrieving data from CD-ROMs, new developments in optical storage, and network access to a CD-ROM drive.

There are still problems related to a lack of standards in some aspects of this "new" technology usage. The group had lots of questions and a few answers. Participants agreed that more presentations and discussion are needed.

CAUSE88 - CURRENT ISSUES SESSION SUMMARY

COMPUTING SERVICE CENTERS AND LIBRARIES: FIT OR MISFIT?

Moderators: **David B. Walch**, Dean of Library Services
California Polytechnic State University, San Luis Obispo
Anne Woodswo.th, Associate Professor
School of Library and Information Science, University of Pittsburgh.

Approximately thirty participants, including a small number of librarians, discussed the relationship between libraries and computing service organizations in higher education, the advantages and disadvantages of administrative mergers, cultural differences, and guidelines for creating effective working relationships.

David Walch described the results of the survey he had conducted which indicated that the supposed increase in organizational mergers had not happened. His study of 60 institutions revealed that 83.3 percent of library directors reported to a chief academic officer; none to a computer related administrator. On the other hand only 30.0 percent of administrators in charge of computing reported to the chief academic officer; most to a vice president of some kind. Anne Woodsworth indicated that her earlier study had found a similar pattern; in only 4 of 91 institutions had the library and some portion(s) of computing and telecommunications been linked organizationally, and in two of those cases, the chief librarian was responsible for comouting and data networks.

Participants mostly agreed that libraries are at once both users of, and partners in campus computing services and as such are unique on campus. Apart from formal organizational linkages, the distribution of tasks and responsibilities between the two units must, in future, be clarified to determine who does what, particularly in helping users with information database systems, be they personal, commercial or the local library catalog. There was unanimity about there being different, but converging cultures in the two service organizations– ranging from educational background and competencies, pay scales and fringe benefits, through position classifications and the status of personnel on campus, to academic versus nonacademic alliances and image on campus. The intersecting personnel factors were seen to be an important issue that institutions must address in future. It was recognized that local politics and traditions play an important part in whether or not organizational mergers take place. General sentiment of the group was that libraries and computing service centers ought not to be merged .

End-User Computing: The Major Issues
Moderated by Carole Barone, Syracuse university

Policy issues dominated the discussion at this Current Issues Session. The discussion ranged from how do you get people to become end-users to how do you keep them from doing it. Other topics included: concerns about duplication of effort, undocumented applications, the importance of training, standards, and clear and comprehensive policy statements. A summary of the discussion follows.

Some participants asked why we should be so concerned that end-users use a tool to make their work easier or their decisions more informed? Others countered that when we shut the access door we could be aiding and abetting the development of phantom systems. Those who voiced this viewpoint emphasized the importance of training and education because it is the end-user's responsibility to make certain that the resulting output is correct and used appropriately. The development of good sense in these matters in a product of the maturation process of end-user computing.

An informed and responsible user should be the goal. The existence of an enlightened set of end-user policies hastens its attainment. Such policies need to address the question of who should have access and for what purpose; who is authorized to conduct institutional research; legal constraints on the collection and analysis of data and dissemination of the results; standards, security, documentation, and maintenance; audits of end-user applications.

End-user support units need to establish a close partnership with their clients. Such units come under various titles, for example, Management Information Resource Center, Information Center, Administrative Support Services. These new units herald a transition in information systems services organizations; they reflect the adaptation of the organization to a new set of circumstances. The end-user expects to be a much more active and interactive participant in the development of end-user applications and in the use of the data stored in these and mainframe based systems. Information Resource Management (IRM) is the term used to describe this new data environment.

In some cases it is best to let the user areas develop their own applications, either because of the nature of the application or because the user area finds it easier to add staff to perform programmer/analyst functions. There are many software products on the market that support end-user computing. Some institutions have taken the step of distributing analysts and programmers into the user areas. Whatever the organizational arrangement, it is important to provide the end-user with a consistent window to the data.

Industrial Partnerships: Are They for You?

CAUSE88 Concurrent Current Issue Session

Moderators: **Leonard M. Brush, Carnegie Mellon University**
Arthur S. Gloster II, California Polytechnic State University

Approximately 30 people attended this jointly-moderated discussion focusing on successful strategies employed by Carnegie Mellon and Cal Poly/San Luis Obispo to acquire current technology to support academic programs and administrative services through partnerships with industry. Each moderator provided valuable insights gained from personal experiences with industry-university partnerships.

Brush described how CMU developed administrative systems and acquired new technology through various partnerships with industry. CMU's approach focused on relational data bases and a platform-independent approach in a DEC-UNIX environment. These efforts are described in greater detail in an article published in the Fall 1988 issue of *CAUSE/EFFECT* ("Leveraging Relational Technology through Industry Partnerships," pages 17-24).

Gloster followed with various examples of industry partnerships which have enhanced both instructional and administrative computing at Cal Poly. Mentioned were the OASIS Project with IBM and Information Associates to develop an integrated DB2-based student information system, a joint venture with Apple and Information Associates to develop an executive support system, and Hewlett Packard's recent donation of 100 student terminals and two advanced workstation labs. Gloster also noted the value of a presidential-level advisory board with strong ties to industry and government in the development of these projects.

The session concluded with a lively discussion as the moderators fielded questions from the participants.

Relational Technology: Do You Need It?

Becky King
Baylor University

After an introduction about Baylor University's continuing conversion experiences while moving from a network to a relational DBMS, an informal discussion of various aspects of relational technology ensued. Many of the schools represented in the group had not yet committed to this technology and their staff in attendance primarily wanted to gather information first-hand from those who had made that commitment. The levels of administrative systems development using relational technology varied from those currently planning implementation of a first application to an institution soon to have all systems operating under a relational DBMS.

The following points were made by the participants with relational experience.

- Careful attention to relational database design is essential. It is the basis of a successful system.

- Normalization, while important to relational database design, sometimes has to be compromised for performance reasons. Joins can be very expensive.

- Relational terminology is easier for end-users to understand, therefore simplifying and improving end-user relations.

- Users require careful training before being turned loose with adhoc query tools.

- SQL is basically a simple language but it can be tricky. There are smart and not-so-smart ways to code the same queries that can result in tremendous differences in performance.

- Flexibility is a big plus for relational systems. Changes are easier to implement under a relational DBMS than under other types of systems.

- Programmer training in SQL is important. But SQL is easier to learn than network/hierarchical DML. Programmers do not have to worry about paths to the data.

- The lack of comprehensive, active data dictionaries is an area of concern.

The discussion of the above hopefully helped clarify some of the issues surrounding the questions posed by the session title. There seemed to be two camps in attendance; those currently or soon to be using relational technology and, for the most part, enthusiastic proponents of it and those still cautiously looking to others for answers to their concerns about relational DBMS.

WHERE WILL FAX FIT IN?

Moderator - Jerry York
University of Cincinnati

This discussion was intended to review and understand the growth and reliance on FAX machines on our campuses. We attempted to identify how Universities were dealing with this technology and what impact it was having on other forms of communication.

The following information was presented to help the attendees have a common base from which to discuss plans and options:

- Sales in 1982 - 64,000 machines: average price $4,400
  Projected sales in 1988 -864,000 machines: average price $2,150
- Currently 2.5-3 million machines installed in US
- Group III machines currently have transmission speeds of 1 page/minute.
- Group IV machines will be announced soon with transmission speeds 1 page/5 seconds.

Ease of use with limited reliance on equipment interfaces (i.e. keyboards) and lower cost are the primary reasons for such a dramatic growth. All attendees agreed that the campus explosion has just occurred in the last six months and everyone is struggling over how to address it.

Some schools are allowing any department with funds to buy whatever FAX machine they want. Other schools are investing in them centrally and installing them in strategic locations throughout the campus. Most schools admit that many more exist on their campus than they know of.

It was agreed that now that a critical mass exists and reliance on FAX machines was high Universities needed to take control of the technology and integrate it into their information plan.

Connectivity options that are currently available include:

- Boards installed in PC's will enable the user to send FAX documents.
- Gateways currently exist for LAN's which will enable the user to send FAX documents.
- Software exists for VAX minicomputers which allows the user to send FAX documents.
- WANG Imaging technology allows the user to send and receive FAX documents.

The session was quite productive and future sessions on the evolution of this technology would be very welcome.

Constituent Group Meetings

Nine subgroups of CAUSE members and conferees met at CAUSE88 to focus on issues unique to their shared work environments. These Constituent Groups are organized to encourage communication among professionals who share specific problems and functions. The groups meet during the National Conference, and occasionally at other times during the year, and the number and focus of the groups change according to members' needs.

Chief Information Officers

Convenor: Joseph Catrambone, Loyola University of Chicago

In the first of two meetings during CAUSE88, discussion focused on criteria used to justify microcomputers, responsibility for user training for computing resources, and what percentage of the total operating budget is reasonable for computing resources. The group agreed that department heads should be responsible for cost/benefit justification for micros needed in their own departments, while justification for public micro labs, dedicated micro labs, and LANs was the responsibility of the CIO. Training responsibility is dependent on the application, and can properly belong to the vendor, the user, or the CIO.

Financial data for Loyola University of Chicago were distributed as a basis for discussion. The data included total university operating expenditures, computing operating expenditures, computing capital expenditures, and percent of total university expenditures attributed to computing. Catrambone asked for similar data from participants' institutions from which he will develop an evaluation and distribute results to all 15 participants.

At their second meeting, the group participated in a brief Environmental Scanning and Cross-Impact Analysis exercise developed by Professor Jim Morrison of the University of North Carolina at Chapel Hill. Participants identified the five major changes which will occur by the year 2000, and five major strategic/technical areas. They then discussed the effects the major changes would have on the strategic/technical areas. This futures research technique can be used to stimulate a planning group in thinking about future events and their impact on the institution.

Community/Two-Year Colleges

Convenor: Gordon Mathezer, Mount Royal College

Among items discussed by the 20 people attending this session were:

•*Networking*—While all agreed that this is strategically important in the long term, not all institutions are willing yet to accept the technology. The best approach was seen to consist of educating people and moving ahead gradually.

•*Information to support decision making*—Many spoke of problems associated with having to meet requests for ad hoc, unpredictable, and complex information, particularly using old, inflexible operational systems. Proposed solutions included achieving familiarity with changing information needs, acquisition of a DBMS and/or 4GL, renewal of old systems, and downloading data to PCs.

•*Role of administrative systems*—"Since educational institutions exist to teach, administrative systems people are doing well if they are seen but not heard," according to one participant. Their role was described as providing a reliable, ubiquitous, effective, and friendly computing and communication utility. Strategic planning is particularly difficult in such an environment, since administrative computing has to follow the frequently-changing academic direction. Greater awareness, better communication, and excellent people skills are necessary for success.

Data Administration

Convenor: Richard D. Sheeder, Penn State University

This group met twice during CAUSE88. After a review of the purpose of the group at the first session, two presentations were made to initiate discussion. Cynthia Golden, Assistant Director within Administrative Systems at Carnegie Mellon University discussed the organization of the University as it pertains to the control of access to administrative data. She also discussed the recommendations made by the Security Task Force at the University, and noted that functional units with responsibility for maintaining data should be aware of legal requirements as well as University policies for release and use of data. Training of University employees was noted. "Pseudonym "accounts, which are accounts not directly assigned to an individual, were considered to be acceptable within strictly-applied guidelines. The Task Force continues to discuss the need for a security officer, but no recommendation has yet been presented.

Bruce Batchelder, Manager of Data Administration in the University Planning Office, Virginia Commonwealth University, spoke about some of the data administration issues which have arisen as a result of distributing the systems development and maintenance resources from a central data processing organization to the primary user offices. The University Planning Office coordinates systems planning among the primary offices, supports the institutional research function, and provides its own systems planning and development needs. Since VCU uses proprietary software extensively, there are numerous data dictionaries to maintain, and the requirement for maintaining consistent data definitions across systems is paramount. The strategic planning process has identified the need to support user access to data, and the IMAGINE package, with its own dictionary, has been installed. User training for this project is a function of Administrative Computing Services, a separate unit, while consulting support on data meaning and relationships is provided by the University Planning Office.

Because of the lively interest generated by the presentations, a larger group reconvened later at CAUSE88 to continue discussion. The group recommended that a distribution list be established on BITNET so that members could continue to ask questions of each other and share concerns throughout the year. The list has been established using LISTSERV at SUVM, and is called DASIG. Members of the AIR SIG will be encouraged to participate so that other perspectives may be included. All CAUSE members are encouraged to join this group.

Four-year Colleges/Universities (over 10,000 FTE)

Convenor: John W. Eoff, New Mexico State University

Approximately 25 conferees met in this session to discuss issues involved in purchasing and implementing software. Participants from Kansas State, Arizona State, and New Mexico State described their experiences with acquiring and implementing vendor software. Of special interest to the group was which data base to use to develop their university's major applications of financial accounting, student records, and human resources—particularly the question of DB2. There was also considerable discussion of the advisability of modifying vendor-supplied software. Next year's meeting will probably remain focused on software issues.

IBM Higher Education Software Consortium

Convenor: Arthur J. Chapman, California Polytechnic State University / San Luis Obispo

At the first meeting of this new constituent group, the primary focus was on introducing the new Higher Education Software Consortium (HESC) offering from IBM, which offers to educational institutions IBM mainframe, mid-range, and RT software at about 2 percent of the commercial rate.

Chapman explained to the 35 participants that he had been elected chairman of the HESC executive committee, a group of 17 universities and colleges which is the liaison between IBM and the consortium schools. Approximately 250 schools are currently HESC members; IBM expects about 800 to 1,000 to join eventually.

Craig Lewis, the IBM representative who manages the HESC, reviewed IBM's motivation for providing this program, emphasizing IBM's commitment to higher education, and answered numerous questions about current HESC offerings and plans for the future.

All agreed that this constituent group is appropriate to inform CAUSE members of HESC opportunities.

Institutional Researchers and Planners

Convenor: Deborah J. Teeter, University of Kansas

This group of about 15 participants identified half a dozen issues for discussion, including:

- maintaining duplicate data bases for IR, for MIS, and for academic units
- Executive support systems (ESS)/executive information systems—what systems are used to extract data from mainframe for use of micros; what are the strategic indicators that ESS should support
- who should be responsible for designing data architecture for the institution
- what is the role for a liaison between institutional research and MIS
- what support does IR need in reporting data to state/federal agencies

Discussion focused primarily on the ESS issues. All attendees agreed that ESS was an emerging technology which would significantly affect traditional IR professionals, and that continued communication on the topic was critical. Dennis Viehland of the University of Arizona (VIEHLAND@ARIZRVAX) volunteered to coordinate communication on ESS, and hopes to establish a BITNET distribution list to facilitate discussions.

Although few sites have begun ESS implementation, almost everyone agreed that it must consist of certain basic components. A planning data base must be constructed which contains historical, summarized data from both internal and external sources. Planning data bases will probably be institution-specific and will be designed to match an institution's strategic indicators and/or critical success factors.

Considerable discussion addressed how an institution identifies its critical indicators. It was generally agreed that executives and senior administrators must be the ones who dictate such indicators. It was also noted that most administrators would need assistance in understanding ESS benefits and issues, and that a series of presentations and seminars on ESS would probably be in order.

Dr. Judith Leslie, a vice president for Information Associates, noted that IA provides ESS services specifically designed to bring executives "up to speed" in terms of ESS issues. She stated that executives must take ownership of an ESS project and that identifying an executive to "champion" ESS is an effective implementation technique. Another quick-start suggestion was to begin with an institution's "fact book" as a source of critical indicators that should be supported in a planning data base.

Other basic components of an ESS system were identified to be ease of use, fast response, and graphics. It was also noted that both PCs and larger systems could serve as the hardware platform for ESS systems.

Later in the conference, the CAUSE Current Issues Committee identified ESS as one of the top ten issues of interest to all CAUSE members. This suggests that ESS will receive high visibility during CAUSE89.

Small Institutions (under 5,000 FTE)

Convenor: Clyde Wolford, Le Moyne College

The Small Institution group focused this year on problems shared among members related to staffing, prioritizing projects, and developing campus-wide communications.

Of particular concern was the rapidly-increasing demand for support and maintenance of both hardware and software. The dozen participants discussed approaches utilized on their campuses and offered suggestions to others.

The impact of distributed computing on the small college campus was also discussed with an eye toward its effect on the computing services organization.

State Systems

Convenor: Erwin M. Danziger, University of North Carolina System

This meeting of about 35 people focused on such subjects as

- the true costs of packaged vs. homegrown software
- advantages and difficulties of developing centralized system-wide applications vs. decentralized campus-level applications
- the rigidity of state-wide purchasing contracts and procedures vs. local campus purchasing flexibility
- advantages and disadvantages of centralized hardware and software maintenance contracts
- the use of 4GL software to support management decisions
- computer center staffing sizes
- budget allocation procedures (appropriations by formula vs. politics)
- the role of the state auditors at the campus centers
- security
- how to influence state personnel system offices to keep salaries competitive

Discussion was lively, and a similar session is planned for next year.

User Services

Convenor: Penny Peticolas, Oakland Community College

This first meeting of the User Services group offered about 16 attendees an opportunity to discuss pros and cons of application development on PCs and how it is administered in various institutions, the use of help desks and "expert users," and chargeback for user support.

The most important outcome of the meeting was the beginning of a network of institutions providing user services. To better use this network, a proposal has been made to profile member organizations through a survey covering such areas as support, standards, and PC maintenance. If CAUSE members did not attend this meeting but would like to be included in such a questionnaire, please contact Debbie Smith in the CAUSE office.

"Writing for *CAUSE/EFFECT*— Content, Form, and Procedure"

This special one-and-a-half-hour semı..ar was offered twice at CAUSE88 by the CAUSE Editorial Committee to share information about the process of writing a feature article for a professional magazine—specifically, for the membership magazine of CAUSE.

Julia A. Rudy, CAUSE Director of Publications and Editor, opened the seminar by explaining what CAUSE is and describing the focus of *CAUSE/EFFECT*, appropriate topics for the magazine, and the kinds of articles published. Mark Olson, 1988 Editorial Committee Chair, described the selection process and the role the Editorial Committee plays. He was followed by 1989 Editoria' Committee Chair Gerry McLaughlin, who talked about the importance of publishing both for professional development and for making a contribution to the profession.

The heart of the presentation was ten tips on how to write effectively, described by guest speaker Carolyn Mullins of Virginia Tech. She has written nine books and dozens of magazine articles, one of which earned her the 1983 *CAUSE/EFFECT* Contributor of the Year Award.

More than 70 people attended the seminar, and many expressed interest in becoming future *CAUSE/EFFECT* authors. Participants were very enthusiastic about the value of the seminar material.

Geri McLaughlin, Virginia Tech

Mark Olson, University of Southern California

Carolyn Mullins, Virginia Tech

Track I
Policy and Planning

Coordinator:
Betty Laster
Winthrop College

Information technologies have dictated the need for strategic planning as well as the development of policy. The integration of new information technologies into existing systems will have a significant impact on the policy and planning for information resources within the college or university. Papers in this track discuss how technologies integration is affecting planning and policy issues, share institutional experiences in planning and policy setting, and relate experiences in coordinating information technology planning with overall institutional strategic planning.

Arthur S. Gloster
California Poilytechnic State University

Frank A. Medeiros
San Diego State University

DEVELOPING A STRATEGIC PLAN FOR ACADEMIC COMPUTING

By

Arthur S. Gloster II
Vice President for Information Systems

California Polytechnic State University
San Luis Obispo
California

ABSTRACT: In 1987, Cal Poly's central computing environment consisted of multiple vendor CPUs acquired over several years through systemwide procurements. Diverse systems overextended central computing resources while denying instructional access to current, relevant technology. When systemwide contracts expired individual campuses could plan academic mainframe replacements to better meet their specific needs. At Cal Poly, intensive evaluation of these needs began in Fall 1988 with a planning session of both faculty and administrators moderated by off-campus consultants. Campuswide discussions with many individuals and groups followed, concluding with a campuswide survey reviewed by discipline-specific and campuswide computing committees. A strategic plan emerged through this iterative process, identifying key goals and objectives. Later, these were refined into specific project plans and budget requests for FY 1989-90 for inclusion in the Campus Information Resources Plan. From this experience, a planning process has evolved, providing a vehicle for the university to explore IRM-related issues through meaningful, positive dialogue.

BACKGROUND

With the advent of a formal information resource management (IRM) organization at Cal Poly[1], it was recognized that strategic planning would be an a required element of the IRM process. Committed to the principle of user driven planning for Information Systems, the campus viewed establishment of a long-range planning unit with a reporting relationship to the Vice President for Information Systems/IRM Designee as essential.

In 1987-88, a campuswide Information Systems Policy and Planning Committee (ISPPC) was established. This new committee was comprised of three administrative representatives, three faculty representatives, and the Vice President. ISPPC would address campuswide computing and communications policy and planning issues in conjunction with existing computing advisory committees, providing a vehicle for user participation in the planning process. The chairs of the Administrative Advisory Committee on Computing (AACC) and Instructional Advisory Committee on Computing (IACC) were added to ISPPC to reinforce this relationship.

The IACC includes representatives from each of seven academic schools at Cal Poly, as well as the library and student body. Faculty representatives also serve on their school's computing advisory committee, providing direct links to department faculty and students. The IACC is currently chaired by the campus instructional computing consultant (CICC), a half-time faculty release position providing additional liaison between Information Systems and the academic community. This assignment is only offered to highly-respected faculty with long-standing interest in computing issues and the ability to place campuswide concerns above their own specific discipline needs.

The IRM process requires each campus to produce an annual Campus Information Resource Plan (CIRP), a campuswide planning tool based on the specific program needs and information resource requirements of academic and administrative programs (see Figure 1). The CIRP is comprised of five basic elements: a campuswide strategic plan, specific multi-year project and implementation plans, annual budget requests for central computing and communications, and a campuswide equipment inventory. Each element is updated annually to reflect the evolving information technology needs of the campus.

By September 1987, Cal Poly had formulated a plan to meet its administrative computing needs, using an IBM 4381 mainframe, a DB2-based version of Information Associates' integrated applications software, and other elements. With this project[2] well underway, the campus could now turn its attention to developing a campuswide academic computing plan consistent with the systemwide planning effort to replace the existing Cyber mainframes by July 1989.

[1] Establishing an Information Resource Management Organization at Cal Poly, Dr. Arthur S. Gloster II, CAUSE 1987.

[2] A Cooperative Research and Development Effort Between Universities and Industry, Dr. Arthur S. Gloster II, WACUBO, May 1988

THE PLANNING PROCESS

To initiate the process, a campuswide planning session was held in November 1987. Moderated by an outside consultant, the session included program managers, ISPPC members, academic deans, Information Systems managers, representative faculty, and members of the Chancellor's Office staff. Over the two-day session, participants analyzed the current state of academic computing, and identified general trends, campus strengths, potential opportunities for expansion, constraints and limitations.

From the two-day session emerged five major goals and objectives, identifying the systems affected, constraints, action items, and responsible parties. Armed with these goal statements, IACC and ISPPC faculty representatives met with each school computing committee, individual faculty, and others to discuss the proposed plans and gather additional information regarding specific academic needs. These discussions resulted in minor changes to the initial goal statements.

Later, a supplementary questionnaire was developed by the CICC and distributed to every department and school through the computing committees. In it, faculty were asked to review sections of the previous year's CIRP and describe curriculum changes impacting their need for access to information services; critical information system needs which could not be met through existing resources; and accomplished or planned changes in hardware, software, personnel and facilities at the department and school level.

Combined with the annual survey of campus computing and communications equipment conducted by Information Systems, this information enabled planners to readily assess each school's resource needs and capabilities. These needs were compared and contrasted to determine which. if any, should be addressed at a campuswide level. When this information was thoroughly analyzed, eight specific campuswide IRM goals emerged. These goals evolved into specific objectives, resource requirements, project plans and budget requests submitted with the CIRP in June 1988.

THE ACADEMIC COMPUTING PLAN

<u>Trends.</u> Two basic schools of thoughts were found to exist regarding computing support for academic programs:

1. Disciplines without a strong tradition of computer usage felt individual workstations at the school and department level were adequate to meet their needs.

2. Applied and technical disciplines with a strong history of computer usage, such as computer science and engineering, regarded access to powerful workstations networked to large central computer systems as critical.

Like many other institutions, Cal Poly had undergone the transition from a centrally managed, equipment-centered information environment to a user-centered, distributed computing environment. It was increasingly evident that the multiple mainframe environment, acquired over several years without a cohesive plan, could no longer meet campus needs. By 1986, these resources were underutilized, expensive to operate and maintain, and unnecessarily complex (see Figure 2). By contrast, the inventory of campus workstations was skyrocketing (see Figure 3) and there was increasing demand for networking

and user support by Information Systems.

Strengths. Campus strengths included the excellent reputation of the university's instructional program; a well-defined mission statement and philosophy; outstanding, long-term connections to high technology industries; the president's advisory cabinet, a group of 40 CEOs and other high-ranking officers representing leading national and regional corporations with special interest in Cal Poly; the newly revamped IRM organization and committee structure; the Computer-Aided Productivity Center (CAPC), a unique specialty center supporting CSU/IBM mainframe research and instruction in computer-aided design and manufacturing, expert systems, artificial intelligence, and other applications. Above all, there was a core of dedicated faculty committed to developing and improving computing access at the campus.

Opportunities. While it would be advantageous for Cal Poly to continue to build on its strengths, new opportunities for expansion would also be sought. These included developing partnerships with other industry leaders, such as IBM, Hewlett-Packard, and Apple; implementing a multi-disciplinary computer integrated manufacturing center; expanding CAPC's mission to include IBM mainframe support for other schools and disciplines; and replacing the existing mainframes with more relevant systems.

Constraints. The key constraint for Cal Poly's academic planning effort remains the lack of available funding for central computing. With an annual budget of less than $3 million, it is difficult to acquire and support even the most basic computing resources, such as mainframe hardware and software, communications networking, and instructional workstations. Using systemwide formulas for student and faculty access, Cal Poly's annual support budget for academic computing should be at least $7 million.

While the State has provided some funding to acquire and support student workstations, the mainframe computing budget is limited to $500,000 for academic and administrative support. There is no formal State funding for advanced workstations, faculty workstations, software, and communications networking. The separately funded CAPC Project was seen as a potential area for increased State support for academic computing.

To move ahead, Cal Poly's plan would have to maximize existing resources (equipment, personnel and budgets), seek increased State support, and take advantage of alternative funding sources such as lottery funds, external research grants and contracts, and industry donations.

Campuswide IRM Goals and Objectives

1. Increasing student and faculty access to computing
2. Implementing the systemwide CSU/IBM Academic Mainframe Specialty Center
3. Providing leadership in information technology
4. Stabilizing the academic mainframe environment
5. Implementing integrated administrative systems
6. Developing and extending the electronic campus
7. Improving central service and support levels
8. Achieving adequate funding levels

Resource Requirements. Based on campus surveys, the following campuswide resource requirements emerged as critical to support the current academic

program at Cal Poly.

1. Mainframe Access and Support. The School of Engineering required access to UNIX. The only available campuswide UNIX resource, a Pyramid 99X, was rapidly becoming saturated. By 1987-88, CAPC's mission had been expanded to encompass not only CAD/CAM research and instruction but also access to software running under VM to support Schools of Business at other CSU campuses. Beyond these specific needs, the mainframe environment had to be stable; support a wide variety of readily available software; facilitate exchange of information across the campus; and reduce the number of centrally supported operating systems. To meet these needs, an upgraded IBM mainframe, communication lines, and software had to be in place as soon as possible.

2. Faculty Workstations. While information technology had become an integral part of every profession, yet computing had not significantly impacted classroom instruction. Analysis revealed that the only school with the policy requiring every faculty member to have access to a workstation (Engineering) was making the greatest use of computers. Most academic schools and the campus as a whole lack the necessary funds to acquire the large numbers of workstations required to fulfill such a policy. Therefore, a high priority was placed on increasing the number of faculty workstations, particularly in the non-technical schools such as liberal arts.

3. General Student Workstations. While student access remained inconsistent with instructional demands, the number of workstations available to students increased dramatically. A number of labs had been acquired through various means, including industry donations. By 1987-88, Cal Poly had nearly achieved its target ratio of one workstation per every 10 FTE and space for new labs was extremely limited. Therefore, increasing the number of student-owned microcomputers and implementing adequate communications to support access from student residences was deemed essential.

   Advanced Student Workstations. Access to advanced UNIX-based workstations is increasingly viewed as necessary component of the instructional program. Disciplines such as architecture, computer science, and engineering now require access to these systems to receive accreditation. The small inventory of workstations resulted primarily from industry donations. Increasing this resource was another important goal.

4. Ongoing Support. The chronic, widespread problem of support (maintenance, software, space, staffing, upgrades and networking) for the large inventory of computing equipment at the school and department level was universally perceived as having a substantial negative impact upon computing in the instructional program. While the campus could equip student labs using various funding sources (equipment replacement, lottery funds, industry donations, etc.), there was no State funding to maintain or upgrade these systems. Meeting this need will be the major, long term academic computing goal.

5. Networking. All academic disciplines require access to student records, library systems, campuswide computing resources, instructional databases and electronic mail. At Cal Poly, the

desired goal was an integrated computing and communications environment with fully integrated, digital switching capability based on standard network architectures. A campuswide broadband/baseband data network had been partially developed and implemented. Several local area networks were in place. Completing the campuswide network and expanding external communication links would be required to support the other academic goals.

ACADEMIC COMPUTING PLAN - ONE YEAR LATER

One year later, each resource requirement was being actively addressed (see Figure 4).

By August 1988, the campus had acquired use of an IBM 3081-KX mainframe to support campuswide instruction and systemwide obligations. As one of IBM's grantee schools, Cal Poly was able to acquire business, engineering and other software through IBM's Higher Education Software Consortium at substantial discount. Schools of Business at three remote campuses were conducting classes on Cal Poly's IBM mainframe.

The campus had acquired several advanced workstations. Sixteen SUN workstations were purchased for student use. Student terminal labs were upgraded with new units donated by HP to support access to the IBM 3081-KX. Other instructional computing facilities were upgraded through donations by Apple, IBM, Tandem, Xerox, etc., and departmental procurements.

The academic community adopted voluntary support standards for commonly used microcomputer softw are packages while UNIX was declared an essential instructional operating system requires support. The campus adopted a policy of encouraging students, faculty and staff to purchase microcomputers. Two highly successful special discount sales were offered by Apple and IBM through the campus bookstore.

A faculty software library maintained by Information Systems was evolving into a faculty technology center providing faculty access state-of-the-art hardware and software for demonstration/evaluation.

The broadband network was in place and several buildings and instructional resources were now linked. BITNET, INTERNET and other information services outside of the university were available, too.

The president's advisory cabinet assigned high priority to student and faculty computing and actively aided in efforts to secure increased funding through State and industry sources.

While progress has been made, the issues of faculty workstations, equipment maintenance, completion of the network, and supporting separate administrative and instructional mainframes remain.

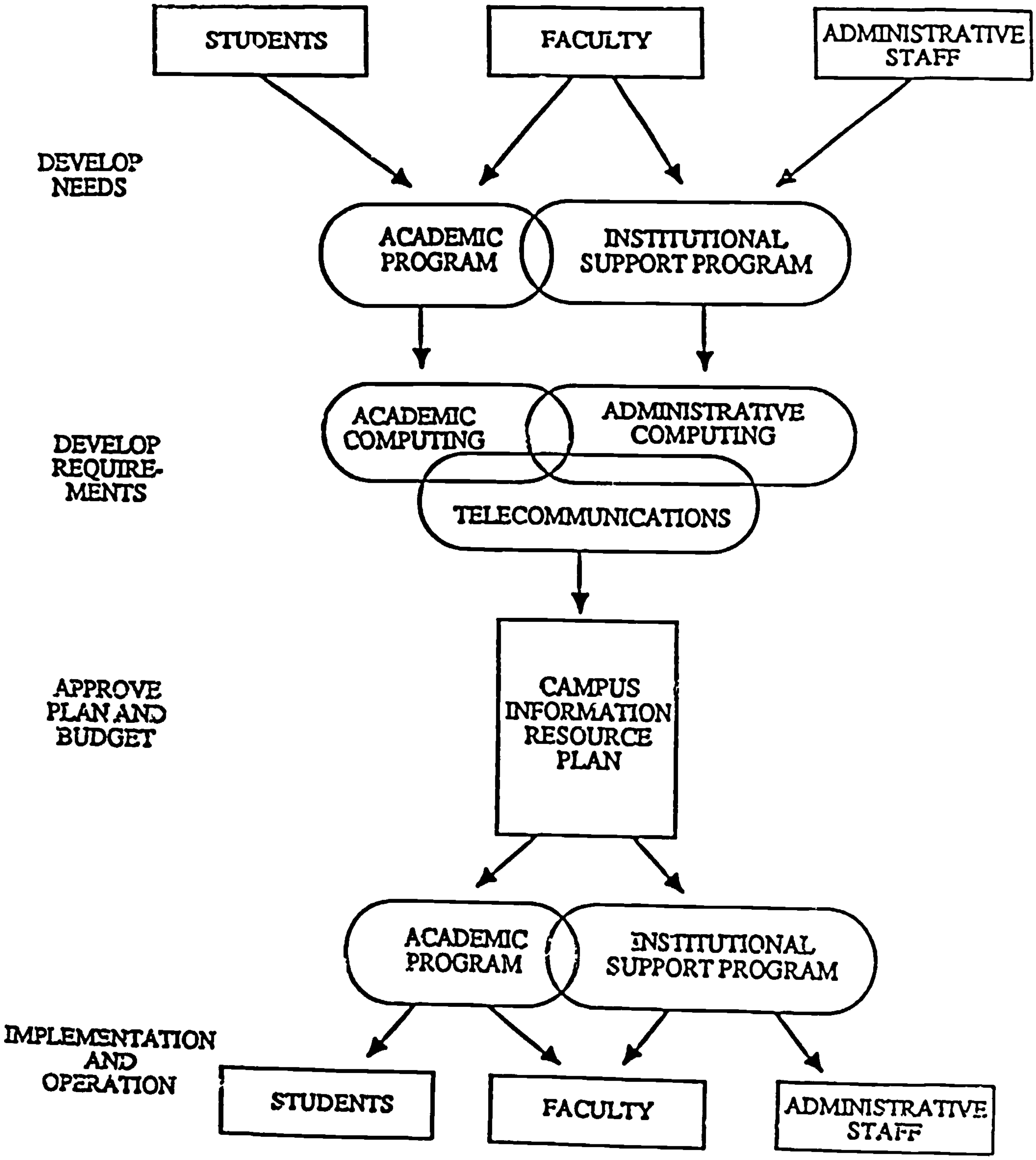
CONCLUSION

Cal Poly now has a workable planning process and framework by which to assess its academic needs, determine resource requirements, and develop strategies to acquire those resources. In 1988-89, Cal Poly will test the framework, make changes, and develop new plans and objectives. Regardless

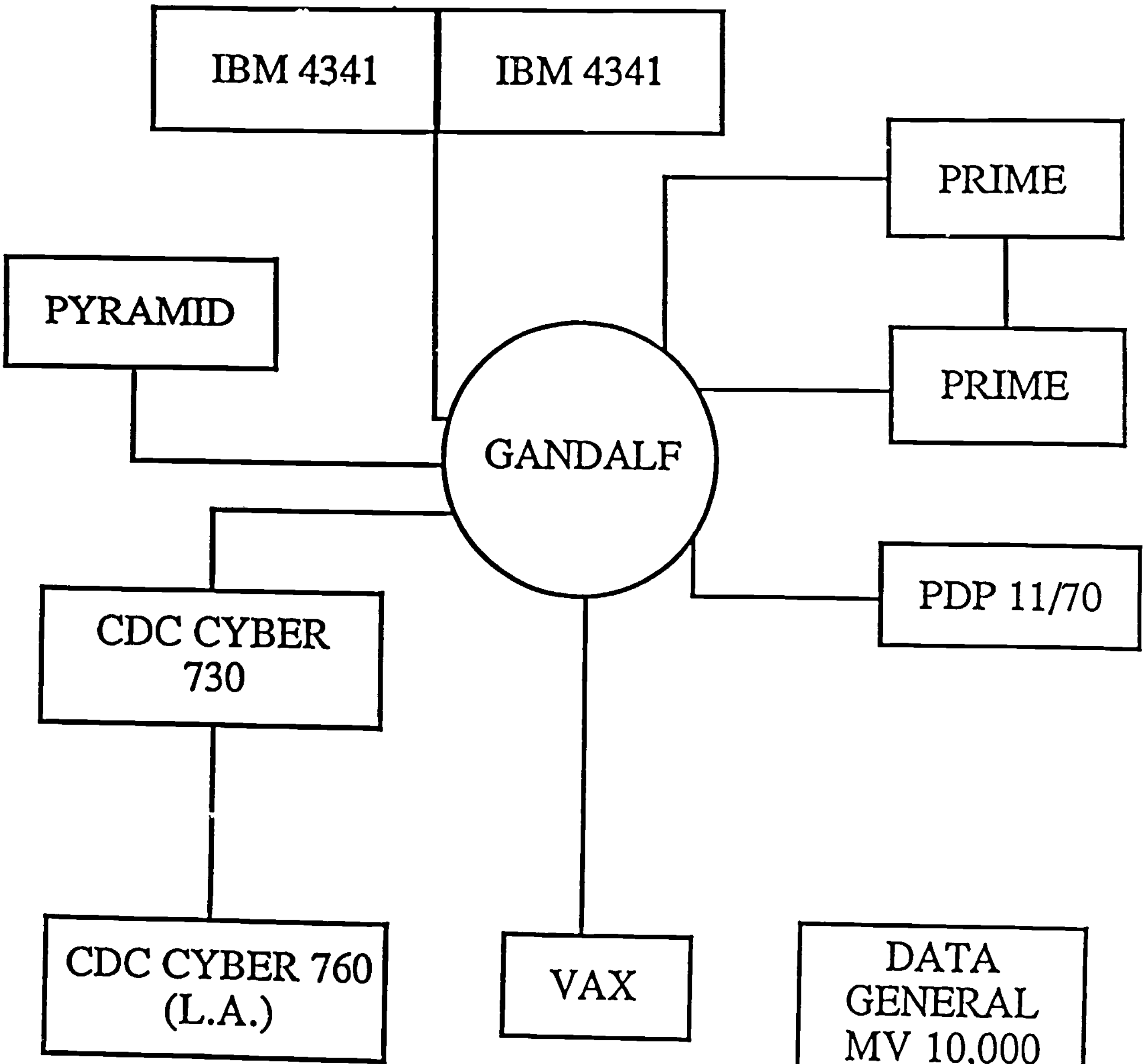
of the outcome, it is critical that the process continue so that California students and faculty will be prepared to meet the challenges of the new information age.

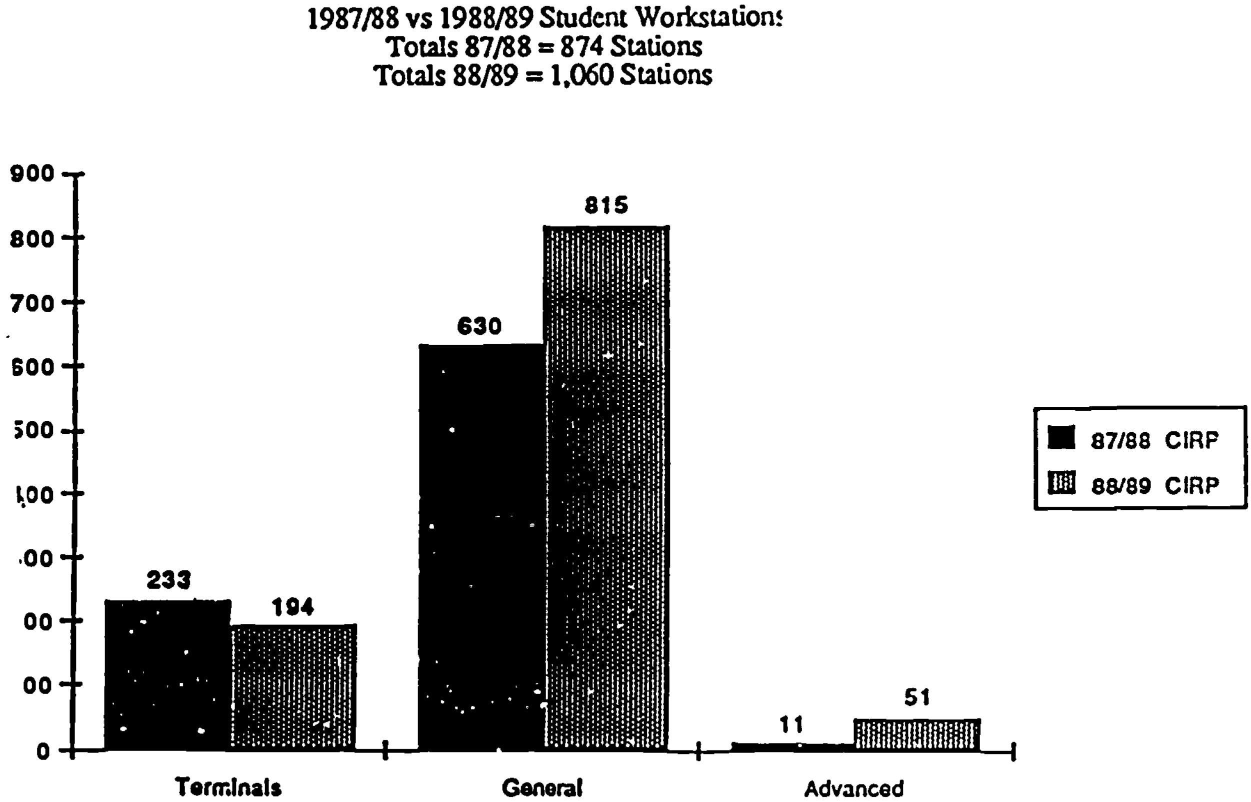
IRM PROGRAM

Planning Framework

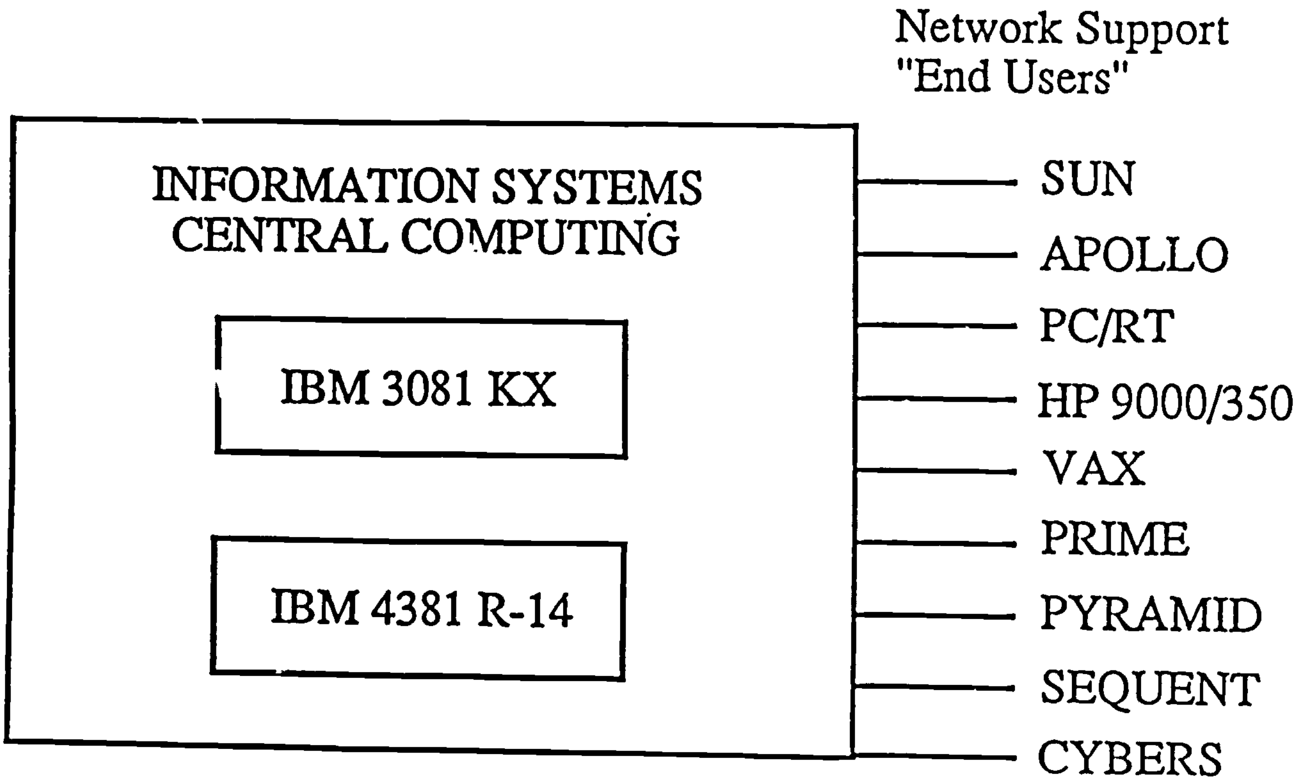


ACADEMIC COMPUTING EQUIPMENT 1986




1987/88 vs 1988/89 Student Workstations
Totals 87/88 = 874 Stations
Totals 88/89 = 1,060 Stations
900
800
700
600
500
400
300
200
100
0
233
194
630
815
11
51
Terminals
General
Advanced
87/88 CIRP
88/89 CIRP

ACADEMIC COMPUTING
1988



Connected by SLONET (Ungermann-Bass)
SNA

NEW TECHNOLOGIES ARE PRESENTING A CRISIS FOR MIDDLE MANAGEMENT

Dr. M. Lewis Temares
Associate Vice President
University of Miami
Miami, Florida.

Mr. Ruben Lopez
Director Support Services
University of Miami
Miami, Florida.

The implementation of the Long Range Information Systems Plan (LRISP) at the University of Miami has brought to the forefront the crisis of competent middle management.

It is fallacious reasoning to assume that new systems will reduce overall personnel costs and they should not be implemented with this as a reason. The number of personnel lines may be reduced but, the people on the lines will need more intensive training.

While we are not suggesting middle management be the primary focus of a business, we must pay enough attention to these managers' functions to ensure that they work together with the business units as part of an integrated whole. Middle management is the glue that holds a University together and, as such, must be made a more integral part of the business decisions. This paper will discuss ways in which the middle manager can become more involved and useful to the organization.

NEW TECHNOLOGIES ARE PRESENTING

A CRISIS FOR MIDDLE MANAGEMENT

The University of Miami is in the fifth year of its seven year Long Range Information Systems Plan. The original plan outlined forty four (44) applications, most of which have been installed in an integrated on-line database environment. Last year, the University, with the aid of Information Resources, in a remarkably aggressive endeavor, implemented eight (8) additional on-line administrative systems, increasing the technological impact across its administrative and academic management units.

In an era when emphasis is placed on productivity and streamlined operations in universities and corporate America, middle management has had to assume new responsibilities, sometimes seemingly abstract, but always complex. In order to survive, middle managers have had to begin to incorporate into the organization the changes introduced by the new technological trends. "The number of changes organizations must endure in order to remain stable and/or grow in today's environment is beyond precise calculation," according to O. D. Resources, an Atlanta based consulting firm that has done extensive research on this area.

This paper deals with the challenges facing departmental middle management, both from the functional integration of the administrative systems and the technological impact on the University's working behavior.

Background

The philosophy of the department of Information Resources team of managers is to be facilitators, coordinators and advisors to our clients. We accomplish this by,

1. Including on our advisory committees and application project teams representation from all of the University's major academic and administrative units,

2. Giving free training classes to faculty and staff in supported software,

3. Training clients on the administrative systems and having an information center with a "help" desk available for advice on purchases and configurations.

4. Maintaining open "information channels" through publications of a bimonthly newsletter and frequent broadcast distribution of technical updates to all University personnel (faculty, staff, administration).

The progress of the Long Range Information Systems Plan (LRISP) is overseen by a high level committee called the Computer Advisory Committee (CAC). Also, every systems project has an Information Analyst from the principal user area and a Steering committee with members from administrative and academic units affected by the new on-line system under development.

All of our administrative applications are integrated under a monolithic database. The development of the application on-line systems priorities were set with input from the user community and our systems analysis staff. The application on-line systems are classified in two categories: basic foundation and distributed systems. The foundation systems were those application systems required as a building block to subsequent systems. For example, "Campus Directory" was the first foundation system implemented. Its functional objective was to build the demographic information of the University in order to develop subsequent administrative and academic on-line application systems. The distributed systems are those on-line application systems with specific departmental functionality. Although these systems can be perceived as standalone applications systems, they are not because of the database integration. For example, the Purchasing System, slated this year for departmental implementation, must be integrated with Accounts Payable, Receiving and Financial Reporting Systems.

Who Is the Middle Management?

Because of any University's organizational structure, there is a basic problem in organizing a technological effort affecting a large group of people. There are two types of departments affected directly by new applications in our institutions: administrative academic units and administration units. These units vary in size, reporting relationships and functions. At the beginning of the long range projects, top management, within the departments, was doing most of the thinking and directing while middle management and staff carried out its intentions. As the project implementation advanced, however, the situation became more complex. The accelerated implementation of on-line application systems created new challenges for the middle managers. This management level needed to train their personnel and migrate to the new on-line systems, while maintaining the expected service levels. This necessitated some significant changes in the basic role of the middle manager.

A resultant change from these challenges relates to the middle manager's function. Typically, departmental units will replace a manual operating system with a sophisticated self-contained on-line application system. The repercussions of this changing technical environment may create new and higher levels of stress for the middle manager. How is he to manage an organization which is growing both in numbers and in subfunctional specialties? At this point, middle management has acquired the technological resources to operate as a business within a business. Excuses have been reduced. Since the manager now has the wherewithal to be responsive to top management, as well as to the organizational needs of his unit, he is struck with the realization of conflict between the goals he has set for his unit and the new goals being set for him by top management. Since management's pent-up thirst for more information can now be met by the middle manager, he can and should perform more of a staff role than ever before, while still fulfilling his line function. He must change the way he does business.

Middle Manager: Integration

Bringing new technology into an organization has always been difficult. Change is stressful. Differentiation creates the need for another process in the organization in which the middle managers play a key role. This is the process of integration.

Since all of the University's application systems are integrated under a common database environment, the data attributes are shared by different applications. Consequently, there are a sequence of activities which have to be performed in

a highly coordinated manner to achieve ultimate productivity. Integration and coordination, while necessary at all levels in the institution, are generally regarded as primary functions of middle management. The middle manager must wrestle with the need to accomplish more, utilizing the same or less resources.

There are reasons for neglecting to manage the changes introduced by technology. They include the comfort of doing things as they have always been done; the past disappointments with computer systems; the low level interest of managers for computer technology; the resentment of this technology; the rapid pace of change it introduces, and the myth of intelligent machines surrounding computers during their first years of existence. These reasons are vanishing as computer applications are more prevalent and middle management is more conscious of the potentials of the technology.

It is only a recent realization that the middle manager has become an important contributor to the integration, installation and implementation of the on-line application systems. Systems used to be developed by computer staffs in a semi-ivory tower. Now, it is understood, client participation must occur when the systems are installed. The departmental staff is impacted by the new technology, and those most familiar with the routine tasks feel threatened by this new technological phase. After discerning the resistance to absorb changes, the middle manager must assume the responsibility for working with the staff, being a champion of the new system and providing the proper direction, education and training. It is important to emphasize education does not mean getting an M.B.A.. Education of the manager as to the organization's goals, objectives, culture and real business must occur. Too many managers do not realize their role in "the big picture." To middle management falls the task of promoting technological change as part of the integral function of the work unit.

Middle Manager: Keep Communication lines Open

During the systems specifications phase, an individual from the sponsoring department (Information Analyst) participates in the design, development and implementation phases. At the same time, a steering committee reviews the functional specifications. While the project is still in the development stages, a great deal of information exchange is generated between the principal sponsor and the project team. Unfortunately, it took the University management some time to learn that these vital communication links were not being accomplished. The assumption that the users would be able to explicitly communicate their needs through the Information Analyst or the steering committee was misleading. The echo of this dilemma surfaced after the

implementation, when middle management realized the new on-line application systems did not provide the expected functionalities.

In essence, the system's sponsor and the system's everyday users needed different output from the system. In his book Systems Analysts and Design, Dr. James C. Wetherbe describes "the five common mistakes made in the determination of information requirements:

"1. The systems analysts assume managers know what information they need.
2. The systems analysts do not determine requirements for the complete set of decision makers.
3. Systems analysts tend to determine requirements for managers one at a time whereas they should do it as a group process.
4. Systems analysts ask the wrong questions to determine information requirements.
5. The systems analysts expect managers to analytically determine their exact detail requirements and get it right the first time."[1]

Thus, them that say may not know and them that know might not say.

Another problem affecting open communications among managers is the political issues surrounding the project development. Recognizing the organization's political environment and dealing with the issues must occur before the end-product is affected. However, since the disposition of the technical staff does not lend itself to involvement or interest in political issues, this kind of negligence can significantly influence the functionality of the end-product. In any case, the unfortunate result of poor communications is all around dissatisfaction at best, and an unusable system at worst.

Middle Management: Confronting the Issues

Some of the changes in the environment are visible, such as on-line application systems, while others are not, such as those involving work-force values. The University of Miami has been beset with new challenges testing the mettle of even the most forward-thinking middle manager. Few in the community believed that the systems would become a reality. Even fewer believed these systems would be implemented faster and more inexpensively than projected. As a result, the middle manager was the least prepared and most affected by the successful development.

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[1]James C. Wetherbe, Systems Analysis and Design (St. Paul: West Publishing Company, 1988), pp. 122-123.

Role

We need to build the middle manager's confidence. By improving top management's ability to cope with future university problems, middle management will be given a greater importance in its communication with top management. Feedback mechanisms must be installed and prioritized. In most areas, this does not currently exist. When the steering committee members are selected to gather the need analysis, the middle manager and his key staff must be allowed input. After all, the success of the new technology is contingent on the implementation and the proper use of the technology. To give middle management the responsibility for implementation without the authority to suggest changes or improvements in the system results in level of organization stress that hamper the effective use of new technology. Writing a beautiful computer system that does not meet the client's needs results in lack of use, lack of goodwill and a lose/lose scenario.

Training

There are differences in morale and feelings of success among staff. Middle management has to be sensitive to the skill levels of its staff. Are they computer literate or not? Is training possible? Can they be spared for additional training? Remember, a department can have access to several on-line applications. If the department is organized by functions, the staff can be trained on all of the systems, or merely the ones most relevant to their job performance. Training, while costly, is inexpensive in comparison to the tangible and intangible losses caused by lack of training.

Development

One area that needs special attention is career enhancement and advancement. How do we prepare our middle management to replace our upper management? If the top echelon has the opportunity to advance, has middle management been given the proper training or consideration to advance? If a management position is available, often a national search is launched. Should we not make sure qualified personnel have the opportunity for career path advancement? Hiring from without, rather than within, can create the perception of lack of respect, raising the questions of honesty and straightforwardness of top management. Disloyalty can be, and often is, a two-way street. Top management feels that middle management is only interested in salary raises or promotions. However, we have found in our own organization, intangibles such as participation in decision making, better communication, effective technical and managerial training have far reaching results on middle management.

Success

Another term worth mentioning is "success." How do you measure or signal success? The University's organizational structure does not allow us to have a standard yardstick. The top management in different divisions may use the performance appraisal or salary increases to signal success to the middle manager. Middle management in turn may see it differently. Greater status in the organization, participation in decision making and respect could be used by middle management to measure its success.
Thus, "Success", to the middle manager, may mean something different from top management's definition. Clear communications, with goals and objectives, must exist before a mutual definition of "success" can be agreed upon. A wrong perception is as hazardous to the health of the University as a real inaccuracy.

Summary

There are external and internal conditions affecting the morale of the personnel within an organization, such as a university. The implementation of eight (8) different on-line application systems can, and will, make any middle manager reach deep into his reserves for help. The external pressure exerted by these new systems cannot be controlled by any middle manager. However, these systems generate new internal challenges and opportunities. He must motivate and be a motivator. He must communicate and be a communicator. The middle manager must be an idea implementor and an idea initiator. Most of all, he must be treated and perform as part of the solution, not part of the problem.

The key to overcoming the crisis in middle management is participative decision-making, respect from top management, good training in preparation for future promotions and help in achieving goals. Top management needs to be less political and more functional. In short, all management levels must work together reducing the autocratic control, creating a more flexible environment, inducing a better team player image, increasing the utilization of resources and improving the financial position. In order to have a winning organization, success, as perceived by all management levels, must occur. To succeed requires commitment by all parties to work together incorporating the technological changes, even if it means changing the way business is done.

An Information Utility:

The Light, Gas, and Water for Information Services

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This paper presentation traces the development of an "information utlity" at the University of Tennessee, Memphis and the establisment of the UT Memphis Biomedical Information Transfer (BIT) Center. The leadership of UT Memphis recognized that information was as important a commodity as money, people, and physical space, and, additionally, timely and effect access to information was central to the successs of the institution. In January 1988, Chancellor James C. Hunt established the UT Memphis BIT Center under the direction of a vice chancellor.

The BIT Center model is analogous to the municipal utility model but instead of providing light, gas and water, the BIT center provides computing, networking, telecommunications, technology training, and institutional research. The BIT center pulls together under one umbrella, most of the activities which impact on information and provides for a coordinated and focused effort on the merging technologies.

INTRODUCTION

This paper chronicles the steps taken by the University of Tennessee, Memphis over a four year period to establish an information utility which provides information systems and services to not only the immediate campus but also to the Memphis medical community. The institution moved from a health science center woefully lacking in the use of information technology to an information intensive health science center, by pulling together under one umbrella organization, Information Systems and Services, those activities relating directly to information--academic and administrative computing, database development and coordination, institutional research, telecommunications(voice, data,video), library information system, and information technology support. In 1982, Chancellor James C. Hunt and his staff recognized that the success of the institution, and perhaps, even the survival of the institution depended very heavily on whether the university could incorporate the use of information technology into health science education, biomedical research, patient care, and public service and whether the university could successfully manage these information resources.

Nontraditional academic departments along with the Biomedical Information Transfer (BIT) Center were established to support the health science education, biomedical research and patient care efforts, and to provide computer literacy, computer training, instructional development, and other information technology support functions.

A campus wide computing and networking strategy was formulated, calling for the creation of a strong central site facility, the implementation of a high speed communication network and the adoption of a state-of-the-art workstation. A satellite teleport (uplink and downlink capabilities) was installed and plans for teleconferencing, teleteaching and telemedicine were developed.

Three years of planning, evaluating, implementing, adjusting, and the adoption of a new technology are detailed.

In 1982, the leadership of UT Memphis, most notably, Chancellor James C.

Hunt, M.D., set as a goal for the institution that of becoming an information intensive campus. In realizing this goal of an information intensive campus, UT Memphis will provide an environment in which good people may have whatever information technology proves advantageous in accomplishing its mission of excellence in biomedical research, delivery of health care services, and health professions education. Also, the university will provide electronic access to all forms of information by faculty, staff, and students in a timely and effective manner. The chancellor felt the long term success of the university depended heavily on whether or not this goal was reached.

CEO's COMMITTMENT AND VISION

In 1982 Dr. James C. Hunt, M.D., was named the Chancellor of the University of Tennessee, Memphis. Dr. Hunt had spent some seventeen years at the Mayo Clinic in various leadership roles and brought to the Memphis campus a vision of the future which would very much depend on advanced technology and in particular, information technology. Dr. Hunt would commit time, energy and resources to an effort that would catupult UT Memphis into the information technology arena. He was convinced the success of the university would depend heavily on its ability to effectively manage information.

One of the goals set forth by the leadership of the university was to become an information intensive campus. In the early part of this decade, several universities aspired to become computer intensive campuses. UT Memphis attempted to take the effort beyond the compter and to focus more on making all forms of information easily available to faculty, staff and students in an electronic mode.

STEPS TAKEN TO ESTABLISH AN INFORMATION UTILITY

A. <u>Creation of Service Departments</u>
Starting in 1982, the Chancellor created the first of several service departments. The first was the department of education which provides support services for health science instruction and biomedical research. The second was the department of computer

science which provides computing and telecommunications services. The third was the department of biostatistics and epidemiology which provides statistical design and analysis. Each of the three departments have faculty who engage in teaching and research, but the primary role is support service.

B. Telephone Business

In 1982,the University made the decision to go ino the telephone business. The entire campus was trenched and voice lines were installed along with a modern voice switch. At the time the cable for the voice network was being installed, the decision was made to lay a pair of coaxial cables for use as a data/video network, anon. This was a wise decision in that the university was able to install a data/video network backbone for about one-third of what it would have cost had the university done it separately.

C. Task Force on Biomedical Information Resources

In 1984, Chancellor Hunt appointed a blue-ribbon committee comprised of biomedical researchers, health science educators, chief information officers from local industries, and leaders in Memphis' telecommunication industry. This group was given the name Task Force on Biomedical Information Resources and was asked to explore the role information technology should play in the future of the University of Tennessee, Memphis. The Task Force issued the following recommendations:

The University of Tennessee, Memphis should respond to the current window of opportunity to become a biomedical information management and transfer hub of national and international prominence by developing the capability to create, store, retrieve and transfer biomedical information to and from any where in the world.

The University should establish an administrative unit, called Information Systems and Services, which pulls together academic and administrative computing, voice, data and video communications, technology support services, and institutional research and database coordination.

The Chancellor should establish the office of Vice Chancellor for Information Systems and Services and appoint a senior administrator who would have authority and responsibility for Information Systems and Services.

D. Computing and Networking
In 1985, the decision was made by the campus leadership to establish a first-rate central site computing facility and to activate the data/video broadband local area network.

INFORMATION SYSTEMS AND SERVICES (ISS)

In January 1988, university leadership created the adminstrative unit, Information Systems and Services (ISS). ISS pulls together under one umbrella those activities directly related to information technology. A vice chancellor position was created to provide leadership and management for ISS.

There are two elements in the ISS organization: the advisory comittee structure and the administrative structure.

A. The Advisory Committee Structure
The Vice Chancellor for Information Systems and Services will be assisted in the coordination and management of the campuswide information utility by the following committee system.

As required by an evolving and dynamic information utility, a campuswide committee governance system functions to establish policy and procedure for the management of information systems and services. Information Systems and Services has developed a participative organizational decision structure composed of three interrelated ISS committees, each of which is integral to the successful implementation and operation of information systems and

services at the University of Tennessee, Memphis. The system includes the Information Technology Steering Committee (ITSC), the Academic Information Advisory Committee(AIAC), and the Administrative Information Advisory Committee (AdIAC).

At the apex of the governance system is the ITSC, chaired by the Associate Vice Chancellor for Information Systems and Services. This committee also includes the Vice Chancellor for Business and Finance, the Vice Chancellor for Facilities and Human Resources, the Associate Vice Chancellor for Administrative Affairs and the Dean of the College of Graduate Health Sciences. The ITSC will meet monthly or more often if needed and is responsible for information systems and services planning and policy. The purpose of the committee is threefold:

(1) Recommend policy to the Chancellor regarding academic, patient care, and administrative computing, information systems, telecommunications systems, and technology support services.

(2) Assist in the refinement of the strategic plan for information systems and services for the University of Tennessee, Memphis.

(3) Provide guidance to the Associate Vice Chancellor for Information Systems and Services as to the best usage of resources allocated to Information Systems and Services.

Supporting the ITSC in the academic area is the AIAC which meets monthly or more often if needed, and is made up of representatives from each of the colleges and a representative from the Library. Chaired by the Director of Computing Systems the committee serves in an advisory capacity to the ITSC by providing communication and feedback loops to the academic and research communities making recommendations concerning service levels and computing needs of faculty, researchers, and students. The charge to the AIAC is:

(1) To recommend priorities for all new applications development or modification for academic projects.

(2) To monitor academic computing projects.

(3) To develop and implement procedures needed to carry out academic information resources policy issued by the ITSC.

(4) To suggest to the ITSC issues which need policy development regarding academic information resources on the UT Memphis campus.

(5) To participate in the development of academic information resources education/literacy training programs for the UT Memphis community.

(6) To recommend to the Associate Vice Chancellor for Information Systems and Services evolutionary strategies for the enhancement of academic user services.

Concerning administrative and patient care activities, the Administrative Information Advisory Committee(AdIAC) provides input to the ITSC. This committee will meet monthly and includes representatives from the central administrative units, colleges, library, chancellor's office, the University Physicians Foundation (UPF), and the BIT Center. This committee will be chaired by the Director of Information Systems. The charge to the AdIAC is as follows:

(1) Recommend priorities to all new applications development or modification for administrative and clinical computing/office automation projects.

(2) Monitor progress and offer constructive criticism on all administrative and clinical computing/office automation projects.

(3) Devise and implement procedures needed to carry out administrative and clinical information systems and services policy derived by the ITSC.

(4) Suggest to the ITSC issues which need policy development regarding administrative and clinical information systems and services at UT Memphis.

(5) Participate in the development of ISS education/training programs for the UT Memphis administrative and clinical community.

(6) Recommend to the Associate Vice Chancellor for Information Systems and Services evolutionary strategies for the enhancement of administrative and clinical user services.

<u>The Administrative Structure</u>
The organization chart for Information Systems and Services (ISS) provides an overview of the current administrative organization reporting to the Chancellor at UT Memphis.

The Vice Chancellor for Information Systems and Services occupies a senior management position with line responsibility for computing, telecommunications, technology support and information systems development and staff responsibility for strategic planning, promotion and coordination in the field of information systems and services. The position exists to advance the use of information and related technologies; to manage and coordinate various centrally provided information services; to develop and monitor policies and approaches to hardware and applications, and to foster, guide, and support decentralized yet linked information resource initiatives.

The Information Systems and Services administrative unit is the result of the reorganization of units and responsibilities that heretofore resided in: College of Graduate Health Sciences, Facilities and Human Resources, and Administrative Affairs.

The University of Tennessee, Memphis, recognizing that information is a valuable commodity, as valuable as money, people and physical space, has created an administrative unit similar to other units of the university

such as Academic and Student Affairs, Business and Finance, Administrative Affairs, Facilities and Human Resources, and Development. This unit is known as Information Systems and Services(ISS) and will be directed by an Associate Vice Chancellor. ISS is the management (planning, organizing, and operating) of the resources (human, financial, and physical) concerned with supporting (developing, enhancing, and maintaining) and serving (processing, transforming, distributing, storing, and retrieving) information (data, text, video, and voice) for the University. The purpose of ISS is to encourage the most effective allocation of information resources to meet primary health science education, biomedical research, and patient care goals, to provide efficient use of allocated resources, and to provide accountability and stewardship for the investment in these resources.

COMPUTING SYSTEMS

This division includes those activities formally comprising the Health Sciences Computing Center except for the user services group which will become part of Technology Support Services. Computing Systems will perform the following functions: academic/scientific computing, corporate administrative computing, local administrative computing, and computer operations/systems.

INFORMATION SYSTEMS

This division currently has one employee. In time, Information Systems will provide and/or assist in the following services: serve as clearing house for information for the university, perform institutional studies and surveys, coordinate database development, serve as gatekeeper of databases, assist in the long range planning function of the university.

TELECOMMUNICATIONS SYSTEMS

Telecommunications Systems will plan, install, manage, maintain, and coordinate all aspects of the three telecommunication utilities: SL-1(voice) network, NETONE(local area data and video network), and the TELEPORT(satellite uplink and downlink). Telecommunication technologies are very interwoven, with voice, data, images and video moving over the same medium in some instances. This ditvision will provide one stop

shopping, installation, software maintenance, and support for all three technologies. An individual who has experience in all three technologies, will serve as section director, providing overall direction and planning for these technologies.

TECHNOLOGY SUPPORT SERVICES

This division provides the following services: office automation support, microcomputer hardware and software support, all forms of computer/information technology training, lowend computer hardware maintenance, troubleshooting of information technology related problems. Also, this section develops and manages the technology demonstration center.

BIT CENTER

ISS will operate within space and facilities known as the Biomedical Information Transfer (BIT) Center. ISS pulls together in one building those persons delivering services in academic and administrative computing, information systems (institutional research and modeling, database coordination, academic and patient care information), telecommunications and information technology support.

The BIT Center operating as an information utility offers the following services on a chargeback basis:

Computing cycles
Voice transfer
Data/Video transfer
Information systems development
Information systems documentation
Information systems training
User support/Technology training

Currently the BIT Center is recovering about 75% of the Telecommunications Systems' budget, 30% of Computing Systems' budget, and about 12% of the Technology Support Services' budget. These figures don't include amortization for equipment. The plan is to increase recovery by Computing Systems to about 40% of gross budget and to increase Technology Support Services recovery to about 25%.

It is expected that the growth of state funding for the BIT Center will slow over the coming years and significant growth will come through recovery and cooperative arrangements with vendors.

WE CAN'T DO IT ALONE

It has become apparent to the leadership of ISS that the University must have outside help in order to reach its goal of becoming a leading biomedical transfer center. The BIT center has developed mutually beneficial partnerships with several key technology vendors. These vendors are Apple Computer, Digital Equipment Corporation, Siemens Medical Systems, South Central Bell, and U.S. Sprint.

CONCLUSION

The leadership of the university and ISS recognize the importance of effective utilization of information. The BIT Center will provide users with the latest information technology tools assisting them in the creation, analysis, transfer, storage, and retrieval of information, thus giving the university a strategic advantage. A strategic advantage at a health science university means UT Memphis will be more competitive for the best health science students, nationally recognized biomedical researchers and quality patient care providers.

THE SHORTEST DISTANCE:....INFORMATION TECHNOLOGY NAVIGATION

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Abstract

The theory and practice of information technology planning and policy formulation continue to be dominated by approaches that are excessively linear and rational in their orientation. This tendency is especially evident in higher education settings. Adoption of a more adaptive multi-dimensional approach seems warranted.

Complete reliance on classical "end-ways-means" thinking results in overquantification, limited planning horizons and organizational inflexibility. In turn, the developmental dynamic (and inherent instability) of the information technology environment is often not taken into consideration. Moreover, relatively high levels of ambiguity and potential for conflict within this environment are generally not addressed in conventional approaches.

A multi-dimensional approach that is sensitive to environmental conditions, organizational values and human behavior is clearly much needed in the domain of information technology activities. Utilizing the notion of organizational frameworks (or "lenses" through which to view organizational processes), a dynamic model of planning and policy formulation is presented.

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THE SHORTEST DISTANCE:....INFORMATION TECHNOLOGY NAVIGATION

By way of introduction to my remarks, let me jump to the end. What I want to convince you of, or at least stimulate your thinking about, is the somewhat heretical contention that information technology professionals spend far too much time cooking up elegantly-structured optimal solutions to problem situations that are conceived in such limited rationalistic terms as to be seriously unreal. This, in my opinion, is some large part of why we experience so much disappointment and failure in computing and other technical domains. We really must adopt a more sophisticated and sensitive approach to the planning and policy issues confronting us now and in the years ahead if we are to be considered credible. As with most things of value, this will take some work.

Some of you may be wondering about the title of this presentation, "The Shortest Distance.....Information Technology Navigation." It refers to what any schoolboy knows: that the shortest distance between two points is a straight line. I'm sure that the brighter ones can even prove this geometrically! Experienced navigators dealing with real-world terrain, however, will tell you that this abstract principle almost never works out in practical terms--it seems that swamps, rivers, mountains or any number of other obstacles nearly always get in the way--thus requiring a more realistic and pragmatic approach to the problem of getting from here to there.

For purposes of this discussion, we might characterize <u>intellectual</u> geography much the same way as well. Seldom do ideas and concepts (to say nothing of genuine insights) flow one from another in a completely logical and orderly progression. Despite our best efforts, often our most reasoned arguments and well-laid plans simply do not take us where we wish to go. And so it would seem quite commonplace to conclude that the world of everyday experience--both in physical and intellectual terms--usually turns out to be a bit less ordered and predictable than many of us might expect or perhaps wish.

Being presumably engaged in the business of the real and present world, information technology professionals might be expected to reflect a well-developed sensitivity to this type of pluralistic interpretation of how things work in everyday life; all too often, however, we do not reflect anything even close to such sensitivity. Indeed, a case could be made that information technologists are among the last groups of professionals to relinquish what are essentially out-dated and misleading if not downright erroneous views regarding the role of rationality in getting things done and working effectively with others. Why such a tiresome and outmoded perspective on the part of those who consider themselves so forward-looking (almost by definition) and a continuing source of technological enlightenment?

Before attempting to address this question, though, perhaps we should refresh ourselves as to the main features of the rational (sometimes called economic) model as articulated in the literature of management and related disciplines. At the heart of this approach is a rational or normative decision-making process consisting of the following components, or something very similar:

* Problem Definition
* Solution Criteria
* Alternatives Generation
* Alternatives vs. Criteria
* Choice
* Implementation
* Monitoring, Feedback/Evaluation

While these categories of activity might be expanded or contracted as the situation warrants, the rational approach in the domain of planning may be expressed in a more abbreviated fashion, contemplating a model comprised of only three essential elements:

1) Ends ⟶ 2) Ways ⟶ 3) Means

As any elementary management textbook will tell you in one form or another, strategic planning is a process by which corporate objectives (ends) are established, strategies (ways) for achieving these objectives identified, and necessary resources (means) gathered for implementing the plan. The order of this activity is generally considered integral to the process.

Although the logic and positive applicability of this "end-ways-means" approach is readily understood, it is by no means unassailable within the context of contemporary management thought regarding planning (see, for example, Hayes). Indeed, the exclusive or exaggerated reliance on rationalistic models is under increasing scrutiny in even much of the popular literature as excessively and unnecessarily limiting in scope and substance. That, it can be argued, has been a central point of a number of works since the trailblazing effects of such books as <u>In Search of Excellence</u> and <u>Megatrends</u> in the early 'eighties. Perhaps we should all be paying more attention to these kinds of observations in terms of their meaning for our professional activities and ways of doing business. Especially, I would submit, information technology professionals.

What are some of the more prevalent drawbacks to the rational/linear methodology or way of looking at things that may be of interest and use to us? In general, overreliance on this perspective yields at least the following kinds of negative outcomes:

* Overquantification of Goals
* Unrealistic Planning Expectations
* Organizational/Individual Inflexibility
* Insensitivity to Environment
* Inability to deal with Ambiguity/Conflict

Put into the context of information technology management, it is not all that difficult to see how these outcomes might be even more pronounced (and therefore even more in need of our attention) in a strictly rationalistic and technically-oriented approach to problem solving.

Let us look to the domain of computing for a moment to understand some of the difficulties involved. In terms of goal definition--call it "target environment" or what you will--the immediate tendency is to describe things in numbers: so many gigabytes, megaflops, MIPs, etc. Or statements such as, "capable of supporting X number of simultaneous on-line users with an average response time of Y." And so on and so on. The point here is <u>not</u> that these numbers are unimportant or unnecessary to an informed process, but rather that too often they are considered goals in and of themselves. Thus, sometimes a false sense of security develops from overreliance on quantification from the outset that can make for potent problems down the line.

In a related manner, an exclusively rationalistic methodology produces unrealistic planning expectations. That is, the (false) definitiveness resulting from this quantitative approach can easily mislead; if, as is usually the case, the planning horizon is too short, the overall utility of the effort is questionable. On the other hand, the belief that current sets of numbers can be extended and somehow massaged realistically within a five to ten year timeframe and that this yields something called "strategic planning" is both naive and nonsensical. We are all justifiably weary of meaningless five-year plans.

Not surprisingly, this monochromatic approach to information technology management issues reflects a rigidity--both individually and organizationally--that can be unnecessarily limiting and ultimately harmful to the enterprise. This inflexibility, in turn, perhaps inevitably results in a more or less pronounced insensitivity to the environment, whether local or extended. Given these kinds of outcomes, we might naturally expect that the ability to deal effectively with organizational and interpersonal ambiguity and conflict would be seriously impeded.

Taken all together, these and related negative/counterproductive outcomes of the rationalistic model serve to make life considerably more difficult for the information technology professional (and, I might add, for other organizational colleagues). If the nature of the environment were relatively stable and the nature of the task relatively noncomplex, this state of affairs might be regrettable but nonetheless survivable. But as

we know all too well, this most definitely does not describe the field of information technology. As the issues grow more complicated and the pace quickens, we simply must get smarter.

Perhaps one very human reason why most of us are so taken with rationality, logic and order is the sheer appeal and comfort of objectivity in a seemingly anarchic and chaotic world. Put another way, it is often easier to understand and deal with the objective domain than to comprehend and act on the subjective. Thus, we frequently attempt to ignore and isolate that which we ought to be embracing. Nevertheless, we may point to some respectable progress in this area.

As was previously mentioned, the implications of the movement away from an exclusively rationalistic approach have become quite evident in recent management scholarship. One of the works in which the importance of the subjective is addressed most directly is entitled (appropriately or not, depending on one's point of view) Radical Management. The subtitle is perhaps more revealing: "Power Politics and the Pursuit of Trust." In any case, the authors state their perspective regarding objectivity/subjectivity clearly and directly:

> Skills to decode and respect the subjective element are what managers operating with a rationalistic mind-set most critically lack. Without these skills, solving problems is like playing cards without a full deck. Situations involving subjectivity arise, but management lacks the orientation to acknowledge their presence and is stuck either misframing problems or forcing solutions which, at best, are only partially correct. Some of the critical skills lacked by managers operating with the rationalistic mind-set are:
>
> 1. Skills to decode and respect the subjective interests of each individual.
> 2. Skills to decode and respect the way the system actually functions.
> 3. Skills to decode and respect the behavior of an individual who lacks a meaningful relationship with the system. (pp. 208-209)

The notion of "misframing" problems (and implicitly, solutions) is of considerable interest as we attempt to articulate alternatives to an exclusively rationalistic approach. In this regard, item 2. above is perhaps most relevant to our concern in a general organizational (as opposed to individualistic) sense. When we think about multiple frameworks or "lenses" through which to view organizations, issues and problems, we are in a much better position to see "the way the system actually functions." The extent to which we possess such understanding will in

large measure determine our effectiveness as individuals and professionally.

What kinds of additional frameworks by which organizational processes are interpreted can be identified? Typlogies vary, but the approach taken by Bolman and Deal (1984) seems quite appropriate for our purposes. Utilizing their schema, organizations can be viewed or interpreted through four distinct frames or components: 1) structural; 2) human resource; 3) political; and 4) symbolic. In terms of our present discussion, the structural category may be considered as reflecting the rationalist, linear approach, the political as an adaptive mechanism; and the symbolic as an interpretive vehicle. These frameworks yield valuable additional perspectives and enable us to think about things of concern to us in much richer and more fruitful terms.

One way to explore the attributes of these frameworks is to describe how standard organizational processes might differ according to the perspective adopted. For example, the following abbreviated format yields potentially useful distinctions.

	Structural Linear	Political Adaptive	Symbolic Interpretive
Decisions	Rational sequence to produce right decision	Opportunity to gain or exercise power	Ritual to provide comfort and support until decision reached
Goals	Keep organization headed in a direction	Provide opportunity to make interests known	Develop shared values and symbols
Planning	Set objectives, coordinate resources	Arenas to air conflicts, realign power	Ritual to signal responsibility, produce symbols, negotiate meaning
Communication	Transmit facts and information	Vehicle for influencing others	Telling stories
Conflict	Authorities resolve	Bargaining, forcing or manipulating	Shared values; conflict to negotiate meaning

Another, less academic method of coming to terms with the concept of employing multiple frameworks in looking at things is to cite a concrete situation reflecting this dynamic. Along these lines, let me relate briefly a true story that illustrates the point. About 18 months ago, a university with which I am familiar came to the realization that a substantial UNIX engine would have to be acquired to meet current and projected faculty needs in Engineering and Computer Science particularly. A tremendous amount of analytical work was accomplished in the technical domain within a very short period and a recommendation to purchase Company ABC hardware was made in July, with immediate installation in mind. The rational/linear process had clearly yielded the "right" answer or best solution to the problem as defined.

The problem with this "problem as defined," however, was that it represented only one aspect of the whole situation. As is most often the case, many other "sensibilities" were also involved. First, there was the timing/consultation issue: would July be a good time to finalize this decision, with very little or perhaps no faculty input? Second, there had been a fairly long history of some animosity and conflict between the central computing services operation and the affected academic departments: would an immediate purchase help or hinder this situation? Third, the notion of forming tangible partnerships between the institution and appropriate vendors had recently quite consciously been embraced by university policymakers: how might the present procurement opportunity fit in? Many other questions of this type came to the fore as well, making for a fairly rich mixture of things to consider.

To make the proverbially long story short, the senior institutional officer responsible for computing decided to pursue these and related multiple agendas in the process of addressing the original, so-called "objective" UNIX issue. In so doing, the university came to grips with a number of longstanding problems in the political and symbolic domains. The actual "go" decision with Company ABC was not formalized until late November, so some time was lost. On the plus side of the ledger, enormous progress was made not only substantively but also politically and symbolically--positive accords were reached among parties internally and a highly successful joint venture between the university and the vendor was undertaken and completed as a result of this multi-dimensional approach.

Now before we get too carried away with building fancy matrices and telling retrospective stories that illustrate the wisdom of our approach to a specific problem situation, perhaps we should pause and recognize a crucial point: that we must conscientiously avoid the trap of substituting one recipe-type approach with another. Put differently, we must understand that the limited "one best solution" methodology is essentially false and almost always leads to trouble. To be sure, we all wind up employing recognizable strategies to address defined issues and problems in ways we hope will be effective, but the fact is that few of us enjoy a 100% success rate. This merely underscores the reality that most professional concerns

and problems are highly contextual in nature, thereby necessitating a dynamic, multi-dimensional methodology if we are to play the game with anything resembling respectable odds.

Clearly, then, information technology professionals need to consider carefully and perhaps rethink their conceptions about contemporary management and what will be required in a future that works. In this regard, let us briefly contemplate several relevant observations put forth in recent research and conceptual efforts within management literature. In an interesting paper on the dynamics of decision making, Einhorn and Hogarth (1987) explore the notion of what they call "thinking backward:"

> Thinking backward is largely intuitive and suggestive; it tends to be diagnostic and requires judgment. It involves looking for patterns, making links between seemingly unconnected events, testing possible chains of causation to explain an event, and finding a metaphor or a theory to help in looking forward.
>
> Thinking forward is different. Instead of intuition, it depends on a kind of mathematical formulation: the decision maker must assemble and weigh a number of variables and then make a prediction. Using a strategy or a rule, assessing the accuracy of each factor, and combining all the pieces of information, the decision maker arrives at a single, integrated forecast.
>
> Although managers use both types of thinking all the time, they are often unaware of the differences. Moreover, this lack of awareness makes decision makers stumble into mental traps that yield bad decisions.

What seems especially useful for our purposes is the concept of using metaphors as a means of understanding a complex and ever-changing environment. Implicitly, this encourages us to adopt a fluid, adaptive approach based on multiple inputs instead of confining ourselves to a strictly linear rational methodology.

Along these lines, in another critique of so-called "scientific" management, Isenberg (1987) contends that

> ...what managers need is a synthesis of rationality and entrepreneurial (or opportunistic) resourcefulness. Strategic opportunism is a way of approaching the complex, uncertain task of management both creatively and vigorously.
>
> ....
>
> Thinking both strategically and opportunistically is clearly not easy. It requires a tolerance for ambiguity, intellectual intensity, mental hustle, and a vigilant eye for new ideas. It requires, in other words, a tough-minded approach to an inherently messy process, the ability to take action in the midst of uncertainty, to 'sin bravely.'

Again, the point here is that a monochromatic view of the world is not only less interesting, but also much less effective.

* * * * *

What does all of this mean for information technology management professionals? In my own mental framework, the word "freedom" comes most readily to mind. What we have before us, if we will only recognize it, is the opportunity to free ourselves from all sorts of negative and fundamentally mistaken perspectives. Freedom from a "closed system" approach. Freedom from a "black box" mentality. Freedom from the "one best solution" myth. Freedor from endless numbers and technical jargon. And, on the other side of the coin, freedom to engage all the insight, understanding and creativity we can muster in attending to the professional tasks confronting us.

It is my firm conviction that information technology professionals have a special obligation to adopt richer, more flexible approaches to solving human and organizational problems. Certainly, a valid and appropriate technical/rati[illegible] component is central to any problem-solving process, but there are [illegible] always additional factors to consider. Conventional perspectives [illegible] rapidly becoming dysfunctional. In a world increasingly dependent on innumerable forms of technology, we must insist on a full spectrum of perspectives by which to manage the enterprise.

Successful information technology navigation requires us to recognize that the shortest distance between two points is often not a straight line.

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ACCESSING INFORMATION FOR DECISION MAKING:

A TOOL KIT APPROACH

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ABSTRACT

This paper describes a pilot project undertaken within the Maricopa County Community College District in cooperation with Information Associates (IA). The intent of the project was to identify an architecture and tools for the deployment of Decision Support Systems (DSS) and Executive Information Systems (EIS) which fully exploited current technology, while providing maximum flexibility for the inclusion of promising new tools and solutions. The project included an effort to identify the information requirements of planners/decision makers, and the evaluation of an IA product which integrates summary data stored on mainframe systems with a menu-driven microcomputer environment for user-driven data analysis and graphics creation, using popularly accepted PC software.

The discussion here includes background on the project, observations on DSS/EIS technology, outlines the planning and progress of the project, and concludes with some ideas and modifications to the project plan that resulted from implementation. The contents of this paper are directed at Chief Information Officers, Vice Presidents for Planning, and Institutional Researchers.

INTRODUCTION: THE MARICOPA ENVIRONMENT

An Expanding System

The Maricopa County Community College District (MCCCD) is the third-largest multiple campus community college district in the nation, with roughly 75,000 persons enrolled each semester. Serving a large county with a population of nearly 2 million, the Maricopa Colleges employ about 2,000 full-time faculty and staff, with 2,500 part-time faculty. Both academic and vocational programs are offered at seven colleges and three new education centers, which are rapidly expanding into full-fledged colleges.

The MCCCD Information Technologies Services division (ITS), under the leadership of Mr. Ronald Bleed, is responsible for the development and maintenance of administrative computing hardware and software, a voice/data/video microwave telecommunications network, and support for academic computing. Over twenty Digital Equipment Corp. VAX systems are connected to a comprehensive Ethernet backbone, which is accessible via more than 2,000 terminal server ports and telephone data adapters. Over 6,000 terminals and PC workstations are available to academic and administrative users. ITS is accountable to an Information Technologies Executive Council (ITEC), which is comprised of several college Presidents, Vice-Chancellors, and a faculty member.

Project Background

In the early 1980's the Maricopa County Community College District began implementing an agenda of changes in Information Technology that included: 1) the shifting of appropriate computing resources from a central site to member colleges, 2) full exploration of expanding microcomputer technology, and 3) new online information systems supplied by Information Associates (IA), a major vendor of administrative software for higher education. All of the IA-supplied systems are maintained and enhanced at the MCCCD central office; representatives from the colleges serve on user committees which evaluate and prioritize all requested modifications to the Student Information System (SIS). The other administrative systems, including Financial Records (FRS), Human Resources (HRS), and Alumni Development (ADS) are housed at the district office. Most of the colleges have their own computer centers and run copies of the SIS system maintained by ITS, with wide latitude for ad-hoc reporting and development of auxiliary systems as resources permit. As part of a joint development agreement, IA has several employees on-site at MCCCD. The MCCCD-IA partnership is considered an important element in the success of current ITS development efforts.

Converging events in 1987 increased momentum and interest in areas which generally fall under the rubric of decision support systems. The college and district-wide strategic planning process was evaluated and formalized, and a Coordinating Council for Strategic Planning (CCSP) was created to generate planning policies and to formulate a district strategic plan. The Governing Board also charged the affiliated colleges to develop appropriate strategic plans. More recently, the budget development process has been restructured to build more explicit linkages between the strategic planning process and the annual budgeting cycle, with more emphasis on long-range planning as an integral part of the budget process. The various users participating in both the strategic planning activities and the budget process (deans and other administrators) voiced needs for better integration and availability of information in forms specifically tailored to the forecasting, planning, and other strategic activities being emphasized. Existing reports addressed operational concerns, and did not deal with the longer timeframes and comparisons of summarized information now

becoming more essential to the decision making environment.

In addition, some administrative decision makers were becoming ardent users of personal computers, and the proliferation of microcomputers in all levels of the organization, along with more "user-friendly" software, created a demand for downloadable information that could be manipulated directly. With the online systems maturing into reliable, well understood tools for collection of data, ITS needed an overall scheme for disseminating such data to meet the new needs.

New IA System Developed

The stage was set, it seemed, for the suggestion from IA representatives that MCCCD assist in the testing and evaluation of a new IA product designed to meet some of the needs described above. Current product literature describes the new system:

> The Information Associates Executive Support System is an information access solution that builds a planning database on your mainframe and provides access to the information through user friendly menus on a microcomputer. It can be used to develop an information system that provides your executives with the information needed for strategic planning and decision making.

Maricopa was selected as a beta site for the IA "ESS" product for a number of reasons: 1) the on-site staff resources afforded us as part of the IA/MCCCD joint development contract, 2) the opportunity to test the product in a community college environment, and 3) the perception on Maricopa's part that more advanced decision support capabilities were needed. The timeline for evaluating ESS and generating feedback for IA called for a full implementation of the system, but it was later decided to defer actual implementation temporarily, for reasons not apparent when the project plan was drafted. To understand the issues involved in this project, some more general background drawn from recent MIS/DSS literature is needed. Information systems theory and folklore characterize the realm addressed by this project as vulnerable to difficulties in planning and implementation.

DECISION SUPPORT: WHAT IS THE QUESTION?

Nature of Decision Making

The phrase "Decision Support System" is subject to such broad, conflicting definitions that many lose sight of the real issues involved in making current information systems more useful in the management and strategic planning processes. Decision Support, considered along with the more recently developed tools commonly referred to as Executive Information Systems, is the obvious evolutionary step to emerge from the current median of administrative computing, often labeled Management Information Systems (MIS). Automating the flow of operational data and providing management with obvious, critical, summary reports or selected detailed data suggests the next phase, which is using information to support more difficult, less structured decisions where knowing what to ask is often part of the question. Questions can also range from one-time issues to more complex operational decisions that warrant a permanent procedure for monitoring a new found (or at least newly quantified) institutional parameter.

Although these kinds of needs can exist at many levels of an organization, a case can be made for targeting the needs of executive man ment first, since the decisions made at that level have the most profound budgetary and policy ramifications. There are many possible "strategic indicators", summaries and ratios which portray and portend the effectiveness of the institution in pursuing its mission. Any technical effort to deliver that kind of information (the goal of the recent crop of Executive Information Systems) must be relatively easy to use in order to achieve acceptance with such a clientele. By definition, the problems addressed are completely anticipated, and may suggest new lines of inquiry without necessarily providing tools to pursue them. The best of such tools not only provide "warning lights" to signal potential problem areas, but allow a user to delve deeper into supporting information, seeking explanations for performance beyond defined bounds.

Immediately, one can see that the domain of these kinds of problems strains traditional MIS/DP methods and techniques, which are optimized for rapid processing of high volume, repetitive tasks. Tools for the decision support process address more dynamic needs and must allow more complex operations to support sophisticated analysis. They require a longitudinal orientation that operational systems typically do not address due to storage efficiency questions. There is an ad-hoc component to the decision making process, and a degree of functional user knowledge and involvement required, that makes enabling the end-user for flexible, direct access to the data the real imperative.

Microcomputer Resources

As such, the arrival of the microcomputer, and the consequent flood of new tools like spreadsheets, presentation graphics tools, and user controlled database management, has helped advance the state of the art considerably. The new tools utilize the local processing resource to enhance the user interface, and provide quality graphical output. This is very important, since the decision making process, at the levels that DSS/EIS must address, is greatly simplified by reducing problems at various stages to graphical representations. A picture is worth a thousand words, or maybe a hundred spreadsheet cells, to coin a phrase. Highlighting critical variables in graphical form helps users visualize both the intermediate results which guide refinements in question formulation, and the more final impressions on which decisions must be based. In addition, the realities of decision making include attempts to influence others, which suggests "presentation quality" high resolution color graphics as the eventual form for system output.

Fourth Generation Tools

Without too much elaboration, it can be seen that the decision making process demands support tools or systems characterized by a degree of flexibility, adaptability, ease of use, and fast iterative development. These elements helped shape the "fourth generation' languages now considered desirable for most MIS applications. What is easy for the programmers is (to an extent) also easy for the end users, as the rapid rise of relational database technologies and associated access tools indicates. The value of these tools on both the mainframe and workstation computers is two-fold. First, ad-hoc access to both internal (mainframe) data as well as anecdotal or external data is enhanced, since it is more cost effective to develop systems to deal with such data. Secondly, the rapid development aspect allows more complicated decision needs to be supported with limited resources.

With all that background, one can understand the problems a software developer would have providing tools to support the often ephemeral, generalized process of decision making. In fact, it is rare to see a product touted as a "Decision Support System," per se. What are available are tools useful for constructing

applications helpful to decision makers in a more rapid, cost effective manner. Current systems are making increasing use of microcomputers to perform the user interface and graphics tasks which are workstation fortes, and use larger host systems to store volume data.

PROJECT PLANNING AND IMPLEMENTATION

Another Ingredient

The availability of IA's ESS greatly influenced the discussion within ITS concerning the need for decision support capabilities. At the same time, the somewhat broader question of end-user/ad-hoc access to information generated interest in fourth generation languages as possible solutions to meet widespread needs. As a VAX/VMS shop, and an IA customer with no real interest in switching to a proprietary database without IA support, the conclusion ultimately reached was that the FOCUS 4GL system from Information Builders, Inc. was a mature product that enabled use of existing RMS ISAM data files and provided much needed reporting facilities.

While FOCUS includes a proprietary database, it also has interfaces to many popular database systems, which protects MCCCD's investment if IA adopts any of several database solutions in the future. FOCUS has graphics, modeling, and application development features that were considered promising. IBI was perceived as a large enough vendor to ensure future enhancements, and was committed to an ambitious SQL-compatibility project. IA was working with IBI to investigate whether FOCUS might fill a niche for other IA customers; eventually, a marketing relationship was formed between the two vendors, putting Maricopa in a position to benefit from IA support of FOCUS with all IA products.

Armed with FOCUS and motivated to move immediately based on the proposed beta-test of ESS, a project plan was devised with the following phases:

1. Planning
2. Preparation
3. Design
4. Information Collection
5. Review
6. Training

The project officially commenced in January 1987 and completion was targeted for the fall of 1988. In order to track the progress of ESS at Maricopa a closer examination of the project plan is appropriate.

Planning Phase

Information Technologies Services developed Strategic and Operational Plans to complement the District and College plans described above. The ITS Strategic Plan was organized to reflect goals appropriate to each area of institutional function:

1. Instruction
2. Instructional Support
3. Student Services
4. Institutional Support

One of the goals identified under the Institutional Support function was titled "Utilization of Information Resources", and was further described:

> To more fully utilize existing information resources, new and improved tools of access, manipulation, production, and dissemination will be made available.

Clearly, the acquisition of FOCUS and was a major step toward fulfilling that goal, and was included as one of the detailed objectives under that goal. Another objective for that goal was created to cover the DSS/ESS project. Titled simply as "Develop Decision Support System", the objective read:

> To provide information appropriate for decision making, the Information Technologies Department, in cooperation with IA, will design and implement a decision support system.

It is worth noting that at the time the objectives were set and the plan developed, there was a perception that "executive support" was less encompassing than the results MCCCD hoped to achieve. Therefore, the use of ESS as an acronym was dropped in favor of DSS, and later PSS, for Planning Support System.

Preparation

In August, 1987, a group from IA made a site visit to MCCCD to present an overview of the ESS product designed by IA. MCCCD obtained the specified IBM-PC compatible workstations (PS/2's were chosen due to IBM discounting), and designated PC software was ordered. IA had determined their product would use "ubiquitous tools," microcomputer packages that were de-facto standards due to wide acceptance. These components included:

1. dBase III+ -- data translation, selection, reporting, storage
2. Lotus 123 -- spreadsheet analysis, data conversion, graphics
3. HAL -- a simplified user interface to Lotus 123
4. Crosstalk -- communication with mainframe, data downloading
5. Harvard Graphics -- presentation quality color graphics

IA devised a very easy to learn and user-oriented menuing system for the PC workstation. In order to minimize the training needed to use ESS, the system allowed users to "point and pick" the data of interest to them, and automatically invoke other components. The mainframe components of the system were designed to create a "Planning Data Base" (PDB), a generalized repository of longitudinal, time-stamped summarized data. The data was to be captured, at user defined intervals, from various operational systems, or external sources. The menuing system and mainframe PDB software cooperated to download data to the microcomputer transparently, relieving the user of a potentially confusing step.

A project team was identified and given responsibility for the evaluation and possible implementation of ESS. The addition of FOCUS as a resource lead to an expansion of the team, as hopes were raised that FOCUS might enhance the process of "harvesting" information from the operational systems. By December 1987, software was delivered from IA for both the mainframe and workstation components. ITEC approved the DSS project structure, signaling design to begin.

DSS Project Team:

Director of Computing Services
V.P Management Services Division (IA)
DSS Technical Lead (IA)
FOCUS Technical Lead
District Institutional Researcher
College Institutional Researcher

Design Phase

The MCCCD project team began the process of identifying Strategic Indicators and how they could be incorporated into the DSS system. The Coordinating Council for Strategic Planning (CCSP) was targeted as the appropriate user group to guide the DSS effort. During this phase, IA provided training to members of the team and continued consultation on site. A "Delphi Technique" approach was used to solicit user input; selected administrative users were asked to brainstorm a list of pressing questions and concerns with their staffs and forward them to the project team. The questions were then collated and organized using an institutional model developed to identify key strategic indicator areas.

As mentioned previously, ESS is based on mainframe and workstation components. The mainframe portion consists of twelve online screens used to describe, control, and enter data manually. The online portion uses existing IA "Series Z" features such as an active data dictionary, help screens, etc. Batch programs are provided to mass-load data, report on PDB contents, and to extract data for downloading under interactive workstation control. Controls are designed into the system to ensure that data is loaded into the system at the time intervals defined for each "request", (summary item type), and that no gaps in the data develop due to undetected operational problems.

IA devised a scheme for classifying ESS data that would enable information from all areas to be organized in a uniform, easily understood manner, based on generalized data attributes:

Information Level	Description	Example
Data Type	Selection	Internal Data
Category	Selection	Enrollment Trends
Population	More Selection	Full-time Students
Target	Type of Data	Headcount
Organization	Sort Sequence	College/Dept
Sub-Category	Cross-Tabulation	Ethnicity/Gender

The system as originally supplied included a menu/data hierarchy that was oriented more to the needs of a four-year academic institution than to a community college. Using the supplied structure as a template, each strategic indicator group from our institutional model was mapped to a "category", and the project team attempted to refine the deeper menu/PDB levels to more closely reflect the community college environment.

Information Collection

The project plan then called for loading information into the PDB using data from both internal databases (Student Information System) and external databases (such as metropolitan area demographics). It was here that the first serious obstacle to progress was encountered. After modifications to the batch programs to reduce the burden of loading 10 semesters of history for 7 or more colleges, the team was advised that the only SIS data applicable would be summaries which reflected each semester's data as of our State Census Date, or 45th day, which is obtained each term by freezing the files for several days to run all required reports. Data which did not agree with published 45th day figures would be suspect, and of little value.

The SIS system had been in operation for a number of years, and under certain circumstances, retroactive changes in course status had been applied after 45th day which shifted certain enrollment figures, but which never caused any operational concerns. The policy of allowing such changes was never questioned, as it caused no problems. Attempts were made to program around this problem, to no avail. The alternative of reading 90 sets of 45th day archival tapes to disk, running dozens of harvest jobs for each, and having to repeat the task for any new strategic indicators dampened enthusiasm for the project. Needless to say, a better process for obtaining a reliable "snapshot" of our SIS data as of Official Census Date has been implemented.

It was also noted that the results of the "Delphi" process for gathering user questions were somewhat problematic: less than 25% of the questions could be addressed using existing operational data, and many of the requests were for very sophisticated views of data that were so closely knit with detailed operational data that it seemed more feasible to provide solutions as new layers built upon existing application systems. The concept of a central database of planning data has wide applicability, but there are dangers to isolating information from its immediate context, from both an interpretation and a software maintenance standpoint.

One insight gained from the initial efforts to harvest data for inclusion into the ESS planning database may suggest a strategy that could enhance DSS/EIS implementation in a variety of contexts. Many times, the data in a system must be massaged using various algorithms and logic steps prior to presenting it to users on reports or screens. Users will insist that values stored in a DSS/EIS environment match these familiar pre-digested summaries. Any attempt to harvest the identical data using a 4GL will require duplicating complicated application logic, and create a redundant 4GL program that adds to the maintenance burden. Since users can identify key summary reports which present the data they need from a DSS, why not augment the existing report programs to capture the data in electronic format at the same time that reports are built?

To run a report which creates a dozen or more cross-tabulated views of a database, followed by a dozen more 4GL "harvest" runs to create identical data in a format that can be loaded into a DSS repository, creates unnecessary operational overhead. Often, the only major issue is to identify standard specifications for each data item used in DSS, so that all programs which create a "DSS feed" output file use identical formats and codes for common data items. This philosophy can be extended to pre-translating values from various applications when necessary to ensure that the DSS view of institutional data minimizes encoding differences for information used in several systems, but stored in different ways.

At Maricopa, one particular SIS program creates more than a dozen student demographic reports, for selected credit hour ranges, all in one pass of the database. Adding the code needed to output the same information in a disk file for DSS use took less than a day, and guarantees that DSS information will exactly match hardcopy reports, without depriving SIS users of reporting flexibility.

Review and Changes

Maricopa, as an institution, has not supported a voluminous hardcopy institutional factbook, relying instead on ad-hoc reporting capability to produce summary information as required. Over the years, some of the administrators at MCCCD colleges have built up their own DSS capabilities using spreadsheets, which usually address long-term enrollment patterns, in lieu of a more static factbook. Other institutions, notably the Santa Cruz and Irvine campuses of the University of California system, have pioneered in the creation of "electronic factbooks", which generally provide the same information found in hardcopy factbooks, but in a more dynamic mode that supports DSS techniques. One advantage to these systems is that they are run on mainframe systems, accessible to the entire user community.

These online factbooks de-emphasize the high resolution graphics facilities of a PC for the sake of access to mainframe data to back up summarized factbook information. Since the mainframe supports storage and rapid processing of volume data, it is desirable to add a layer of information in between the operational databases and the high-level summaries of a factbook or EIS. Sometimes termed "analytical databases", this layer provides selected detail information, extracted from operational systems and tailored to DSS needs. Questions raised by factbook or EIS usage can be then be addressed in a timely manner by digging deeper into the analytical database that was used as a source for the EIS level data. This middle territory is the range of questions which good DSS capability will address, often as a result of issues raised by more consolidated information in the executive oriented components of a system.

Although the timeline for ESS implementation has been extended to allow more time for the modified approach to data harvesting, and to allow for expanded DSS capabilities, MCCCD is excited about the potential now developing for addressing a broad range of DSS needs with a flexible, integrated set of tools for the support of decision making. Since one of the goals for the system is for user interfaces to be self-explanatory and require minimal training, it is envisioned that users who want to make use of basic facilities will receive training on package software of their choice through existing channels of course delivery. Specialized training for those capable of using more arcane features of FOCUS or related DSS tools will be handled on an as-needed basis.

CONCLUSIONS

By adopting a philosophy which supports the development of analytical databases, and an online electronic factbook available on the mainframe, Maricopa has positioned itself to benefit from the "best of both worlds". EIS support for users who need the ease-of-use and graphics strengths of PC's, blended with the more generic DSS tools that a mainframe 4GL environment (such as FOCUS) provides, is the architecture for DSS/EIS which evolved out of our DSS efforts. In addition, building a DSS layer and factbook using FOCUS has expanded the "tool kit" to include additional mainframe and micro-based software packages (such as SPSS-X for statistical analysis) in an integrated DSS environment.

With FOCUS-based tools providing an integrated DSS platform, and the potential of the IA ESS system for executive access, MCCCD is moving forward to empower decision makers with the information they need to chart the course of a large, complex institution offering a wide spectrum of educational opportunities. The project has been very successful as a vehicle for bringing to light the complex issues involved in implementing decision support systems.

DEVELOPING DATA ACCESS POLICIES IN A DECENTRALIZED ADMINISTRATIVE INFORMATION SYSTEMS ENVIRONMENT

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Abstract:

This paper describes the development of data access policies in a decentralized environment and the impact of the introduction of a data query tool on those policies. The University is implementing software for the purpose of expanding data access by allowing end users to directly interrogate the administrative information system files. This is in response to the commitment to expanded end user access to administrative data in the University's Administrative Information Systems Long Range Strategic Plan. The current environment is described, including access to data, policies, and the demands of the strategic plan. The proposed policies and procedures are covered with an accompanying discussion of the issues involved.

Background

Decentralized Administrative Computing

Responsibility for Virginia Commonwealth University's administrative information systems has been decentralized since 1985. Until that time, administrative information services were provided by a central administrative data processing unit. As a result of decentralization, Administrative Data Processing staff and associated resources were reassigned to the appropriate majo administrative units along with the authority, accountability and responsibility for delivery of administrative information services. The central computing facility continues to operate as a utility servicing both administrative and academic computing needs. Most major administrative systems consist of software packages from a variety of vendors.

Committee Structure

The Computing Policy Advisory Committee (CPAC) makes recommendations on policy, priorities and funding for all computing to the Vice Presidents. The Administrative Information Systems Advisory Committee (AISAC) provides advice to CPAC on administrative computing issues, while two academic computing committees make recommendations on academic computing issues. AISAC has an Applications and Operations subcommittee which both initiates discussion and responds to requests from AISAC.

AISAC has recently been restructured to provide more emphasis on user representation. Prior to restructuring, the committee membership consisted of senior administrative managers, most of whom had administrative systems reporting to them. The present structure allows for three vice presidential "at-large" representatives, three academic or administrative "unit" representatives and the chairman of the AISAC Applications and Operations subcommittee. Of the current seven members, only two have administrative systems reporting to them. The Applications and Operations subcommittee membership, which previously consisted only of application system managers, has been expanded to include two "at-large" user representatives.

Data Administration

The Planning and Budget Division of VCU consists of three Departments, Institutional Studies, Budget Operations and the University Planning Office. This division is highly visible in the committee structure with the Associate Vice President for Planning and Budget serving as a vice presidential designee on CPAC and the Executive Director for University Planning chairing AISAC. The Director of Institutional Studies sits on the AISAC Applications and Operations Subcommittee.

Responsibility for data administration and university wide management reporting has been assigned to the Planning and Budget Division. The committee participation and the assignment of data administration are largely due to Planning and Budget's role as an integrator of information from multiple systems and its inherent interest in the integrity of administrative data.

Data administration in a decentralized environment utilizing packaged software systems requires its own unique definition. Data administration's usual role in the system development process is minimized by the use of software packages. The emphasis at VCU has been on improving the ability of administrative systems to support management reporting and planning efforts at the institutional level. With the introduction of a user query tool, this is expanding to include data administration support to a broader constituency at the school and department levels.

Basis for Change

Current Access to Administrative Data

All of the major systems have CICS on-line inquiry access for their users. The availability of these screens varies widely from system to system, depending largely on the sophistication of the accompanying security software. The inquiry screens provide fast, direct access to single records of a single system. An inquiry screen will present information for only one entity at a time (a single student, staff member or financial account). To obtain information about a group of entities (all accounts for a given department) requires individual inquiries be made for each member of the group and the information manually aggregated. Information requiring data from more than one system requires separate inquiries into each system.

The alternative to use of the CICS inquiry screens is to request programming support from one of the system support groups. Most of the support groups maintain programming staff partially assigned to fulfilling user information requests.

The problems of priorities, volume, and communication of user needs make this route often inappropriate for information that is required quickly and that may require numerous changes in specification before the desired results are obtained. If the information is needed on an irregular basis, each generation requires a request to the support group.

If the information requires data from several administrative systems, the request is often routed to Planning and Budget, where there is experience in data integration. Limited resources in this area result in this kind of support usually being provided only to executive management and university wide committees.

Present Access Policies

As CICS access has been provided to users, security guidelines have been established independently by the major administrative unit responsible for each system. Each area has procedures for obtaining CICS access and forms which must be completed and signed indicating the access to be provided and the user's commitment to uphold the confidentiality of the information. The security is usually built into the system software and the user is provided access to those records which are under their managerial responsibility. The present policies restrict themselves to only those security issues which must be addressed before allowing CICS access.

A few users can directly access system files in batch mode. For anyone whose responsibilities are not at the university level, extract files have been created containing only the data for their area. Creation of the extract requires system support group intervention.

Strategic Long Range Plan

One of AISAC's major achievements has been the development and acceptance of a Long Range Strategic Plan for Administrative Information Systems (July 1987). The 1987 Plan identified increased access to administrative information as a primary issue which needed to be addressed. The ability of each user to independently access data as easily as possible to assist in performing management and operational functions was defined as critical. The intent was to provide ease of access to satisfy the informational and operational decision making needs of the university.

The Plan recognized that expanding user access implies certain responsibilities on the part of the user, and the existence of a need for central administrative controls to establish and enforce administrative policies and procedures that deal with issues such as data ownership, data custodianship, access rules and responsibilities.

To address these issues the Plan called for implementation of technology which would promote universal access and availability of data, and for the recently created data administration function to coordinate the development and implementation of the required administrative policies and procedures.

Introduction of the Query Tool

The AISAC Applications and Operations subcommittee began reviewing options prior to the actual approval and distribution of the Plan. A number of data base products from the major vendors were reviewed by the committee. Most included some kind of "transparency" mode which worked in one of two ways. The first method allows the data base query function to read the existing VSAM files, requiring no changes in application system software and files. This method provides the user access without modifying production software, but in a less efficient manner than a true data base. The second method provides an option to run existing programs against data base files which are structured to appear as the original VSAM files. This provides better query response, but may impact production efficiency and brings future software vendor support into question. Neither method allows the restructuring of the data normally associated with the data base environment. Our dependence on vendor supplied maintenance, the fact that our application software vendors were not yet congregating around a single database vendor (which would allow us to buy their data base versions) and the problems with transparencies resulted in a decision to put the database decision "on-hold" and concentrate on what is required to provide "universal access" while protecting our current system investment.

A committee of system managers and users was formed to state our needs and generate an RFP (Request for Proposals) which described our requirements. This process ultimately led to the purchase of the IMAGINE product from Computer Corporation of America.

The primary factors in the choice of IMAGINE were ease of use for non-technical staff, the ability to read existing administrative system files and the functionality of combining elements from various system files to satisfy a single information request.

With the restructuring of AISAC it was clear the IMAGINE project would be underway prior to the approval of any drafted data administration policies. As an interim measure, a specially selected group of IMAGINE users were asked to specify what their data needs would be, and this information was forwarded to the system managers with a request for cooperation in making the files available.

We have found the system managers to be very cooperative in this process. The debate and disagreements present in earlier discussions over allowing access by "generic users" to "generic data" were absent when discussing specific users accessing specific data with a known tool.

Issues

While we have data security procedures for each of the systems that have provided CICS access, these procedures have been developed in isolation and only address the concerns associated with this type of access. The nature of universal access by query tool requires policy statements that address more than data security. The enhanced access and flexibility require new roles and responsibilities for both users and systems personnel be defined. The issues raised by the introduction of IMAGINE and how our draft policy addresses each of them is discussed in what follows.

Legality and Privacy Issues

Widespread access to larger volumes of data requires restating and re-emphasizing the individual's right to privacy. We must insure these rights in a new environment where a larger audience will have control over the distribution of data. The control points previously provided by limited access to data must be replaced by a widespread understanding and agreement of what those rights are. Individuals within an academic department must understand and uphold those rights as well as the Registrar's Office has done in the past.

Privacy issues and legal requirements for maintaining faculty, staff and student privacy were raised very early in the AISAC subcommittee meetings with a wide range of views being expressed as to what the law required. Since this seemed to be a recurring theme in our discussions, the University's legal counsel was asked to consult with the committee on privacy and the law.

Briefings on the Family Educational and Privacy Rights code (the Buckley Amendment) and the Virginia Freedom of Information Act were given. The Buckley Amendment places clear restrictions on who may have access to student data. For the committee's purposes this was stated as access may be provided to those who have been determined by the institution to have legitimate educational interests. The Virginia Freedom of Information Act, to the surprise of some committee members, deals primarily with the public's right to access and therefore has minimal impact on data access internal to the institution.

The bottom line is that individuals have certain rights to privacy and a right to see their records. Policies should be established using a common sense approach, followed by a legal affairs review of the draft.

Several alternatives were considered for addressing access rules in the policy. These ranged from specifying access rights on a system by system basis to omitting any discussion of specific access rights within the document. A desire to keep the policy as flexible as possible led to the classification of all data in which individuals were identifiable as "confidential". This was seen as not only meeting the basic legal privacy requirements, but also defining an additional level of privacy the institution would support. This does not rule out the extension of the confidential label to other data the institution determines should have limited circulation.

With the definition of a minimum level of privacy established, a university wide minimum level of access needs to be defined. This is done by establishing "standard access rights" for an organizational unit to its data. At a minimum, an organizational unit will be provided access to administrative data for that unit. This in no way limits the custodian from providing additional access to those with a legitimate institutional need.

This standard access right is provided to the organizational unit head, who may in turn delegate this access to subordinates. The unit head, however, retains responsibility for data confidentiality.

Enforcement procedures and penalties are not defined in this policy. A review of other existing policies found the University's Computer Ethics Policy coverage sufficient in this area.

Ownership vs. Custodianship Issues

With direct access to data, the intervention previously required of the systems personnel is absent. This presents the systems personnel with a role different from the "controller" operating mode of the past.

Departments responsible for programming and maintaining administrative systems have been known to behave as though they "owned" the systems under their management. This has often been evident in the unwillingness to allow outsiders access and to share information about the workings of "their" systems. Decentralization can encourage this attitude by bringing programming staff and functional unit staff under the same roof.

Introducing the concept of a data custodian can alleviate the problems associated with an ownership mentality. It must be made clear that, without reducing any sense of responsibility for the systems and the data, it is the University that "owns" the system and the data, and there are legitimate external users of the system and data.

The draft policy defines the data custodian as the "organizational unit assigned responsibility for logical and physical integrity of administrative data". The custodian retains sole rights to any modification of the data.

Control and Accuracy

One of the major impacts on policy presented by user access to data is the risk of misuse or misinterpretation of the data. There are many opportunities for incorrect presentation of data due to subtleties built into the systems that will not be understood by the user. This was not previously perceived to be a problem since the intervention by system personnel who understood the system and the data was always required to produce information.

Elimination of these subtleties by adding or modifying data elements, and ongoing data education for the users are the tactical responses to this problem. From a policy point of view, the user must be made to understand that he is responsible for accurate use and presentation of data. There is an obligation on the part of the user to understand the data with which he will be working. The custodian is responsible for making known subtleties and conditions that can lead to incorrect presentation. This requires a sharing of knowledge about the system that was previously regarded as proprietorial.

Decentralization and Administration

It can be tempting to create a centralized function when considering the control of access to data. Having a single contact for users requesting access and reducing the demands on the data custodians in dealing with each request encourages the establishment of a centralized function.

Our administrative systems have obtained CICS screen access over a period of years, and each has in turn established a process for requesting and granting access as it obtained online features. Since these functions have been established and staffed internally, and in most cases combined with a training and support function for their users, it did not seem reasonable to call for establishing a central function. We therefore plan to recommend the data custodians as access administrators. The current draft policy attempts to limit the volume of routine paperwork for the data custodians by granting standard access without forms and signatures. We hold little hope of retaining this provision in view of past audit concerns.

Accepting the data custodians as access administrators, there is a need for an appeal process when access is denied or when other issues cannot be resolved.

Data Administration was considered as a possibility in reviewing appeals for denied data access requests. This has been done successfully in other institutions, however, data administration was not interested in such a responsibility, since its function had been established as a coordinative one, with an expectation of achieving its goals through persuasion and value of argument rather than stated authority.

Establishing AISAC or the subcommittee as the focus of appeals was considered. The advisory nature of the committees and the frequency of committee meetings eliminated this track.

It was finally decided to recommend the established lines of authority in appealing denied requests. Appeals would be made to the management of the data custodian denying the request. This decision was made based on the assumption that the appeal process should seldom be required. Data Administration was set up as ombudsman for the appealing parties in the hope that a third party could clarify existing positions and thereby limit the number of appeals.

Organization of the Policy

Since the policy is expected to be distributed widely within the university, it is our desire to have it brief and clear. It has been organized into five concise sections. Under "Rights", the rights of users and custodians are defined. Standard access and delegation of authority are also covered. "Responsibilities" deals with confidentiality, official uses of data, providing data to external parties and the responsibilities of users and custodians towards accurate presentation. Request, Denial and Appeal state the procedures associated with gaining access.

Current Status

This policy will be presented to AISAC for their review, comment and to recommend approval of the policy to the University's Computing Policy Advisory Committee.

Conclusion

A good deal of the draft policy is simply formalizing as university wide policy, practices that have developed under decentralization. We have reviewed those practices and determined that with some basic guidelines, determination of confidentiality and granting of access should remain decentralized. We have carefully avoided recommending the creation of a new central authority.

The introduction of "universal access" has required some statements of policy regarding the rights and responsibilities of both users and custodians. Once these statements are made, it becomes a matter of ongoing education to remind everyone of their proper roles.

ADMINISTRATIVE DATA ACCESS POLICIES

DRAFT POLICY

Rights

Faculty and staff requiring administrative data for official university business will be provided access. The term "access" means to read or view administrative data. Access does not include the ability to create or modify data. Creation and modification of data can only be done by the data custodian. A data custodian is the organizational unit assigned responsibility for logical and physical integrity of administrative data.

Data in which individuals are identifiable is designated confidential. This policy guarantees a "standard access" for an organizational unit to its confidential data. An organizational unit is a formally recognized entity of the institution. Standard access does not require a formal request for access.

Individuals provided access may delegate access to subordinates, provided they first notify the data custodian in writing. The data custodian may then require separate requests in the name of the subordinate.

Responsibilities

Individuals provided access to confidential data are required to maintain the confidentiality of the data. Individuals who delegate access to subordinates retain their responsibility for maintaining confidentiality.

Administrative data shall be used solely for official University business.

Only designated offices may provide administrative data to entities external to the university.

Individuals who access data are responsible for the accurate presentation of that data. Data custodians are responsible for making known the rules and conditions which could impact the accurate presentation of data.

Request

Access to "confidential" data which is not provided through the standard access provision requires a written request be made to the appropriate data custodian. Data not designated as confidential does not require a request for access.

Denial

The data custodian must provide, in writing, the reasons for any denial.

Appeal

Denied requests for access may be appealed to the senior level official responsible for the data custodian. All appeals should be made through Data Administration, which will serve as ombudsman.

SURVIVAL SKILL FOR THE COMPUTER CENTER IN THE UNIVERSITY OF THE FUTURE

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ABSTRACT

Computing services organizations in higher education are challenged by complex problems on and off campus. In addition to the usual tight budgets, heavy work loads, personnel problems and rapidly evolving technology, they are experiencing competition for computer resource dollars and authority.

A new insidious problem has developed. That is, establishing an appropriate role for the computing services organization on a campus fragmented by shared resource ownership and distributed decision-making.

Managers of computing resources organizations have not found a simple and sufficient responses to these new challenge

SURVIVAL SKILLS FOR THE COMPUTER CENTER IN THE UNIVERSITY OF THE FUTURE

INTRODUCTION

Two books currently near the top of the list of best selling books are Swim With The Sharks Without Being Eaten Alive By Harvey Mackay and All You Can Do Is All You Can Do by A.L. Williams. The titles are fascinating and, if you think about it for a moment, the books must have been written for managers of computing organizations in higher education!

Sometimes a friend, vendor or business associate will use the term "real world" when referring to enterprises in the private sector. Initially, I was a little put off by those comments but now I realize they may be correct. Higher education computing services management problems are sometimes --- "unreal"!

CHANGING EXPENDITURE PATTERNS

Let's take a look back a few years to get some perspective on changes that have occurred during the past years to create today's "unreal" problems. "In the beginning" the computer hardware choices were quite limited. Initially, computers were all centrally located and under the control of the computing services organization. Minicomputers comprised about six percent of expenditures at the beginning of the 1970's and 19 percent by the end of the decade (Laster, 1988) . However, microcomputers began to appear in the mid-1970's and were 19 percent of computer expenditures by 1980. By 1987, minicomputers had increased to 20 percent of expenditures and microcomputers expenditures equaled mainframes at 40 percent of the market.

The distribution of expenditures for personnel, software and hardware changed over the years. Personnel expenditures remained at about the same ratio to hardware and software ---roughly equal to their sum (Laster, 1988). Software expenditures shifted dramatically though from about 50 percent of hardware costs to about 50 percent more tnan hardware costs. Of course, the amount of money associated with expenditures increased dramatically. Improvements in technology decreased the cost of hardware and increased its capacity. The infant software industry grew up along with the rest of the computing industry.

What can we expect in the future? Let's take a look at one of the factors that drives the evolution of computing resources, research and development spending. Expenditures on R & D have increased as rapidly as expenditures in the rest of the industry. Therefore, we can expect change for computer hardware and software to continue rapid escalation in the future!

COMPUTING SERVICES ORGANIZATIONS REACTION TO CHANGE

Okay, you're right! Everyone knows the computing industry is dynamic. So, let's consider a related question, "Have computing organizations changed their business practices at a rate commen-

surate with changes in technology"? Regrettably, I have to confess that the answer is "no". The user community moved ahead of us on microcomputers with state-of-the-art software products for graphics, word processing, spread sheets, desk-top publishing, databases, etc. Increasing the capacity of micros, refining software products and networking distributed resources in the user community challenge the mainframe and its keepers. Industry trends have clearly undermined the status of computing organizations.

Computing organizations exacerbated the market situation by their reactions to the changing environment. Some characteristics of computing organizations that further alienated the user communities were:

1. Isolation from strategic planning
2. Focus on short-term objectives
3. Intolerance of new ideas
4. Charge-back policies
5. Excessive rationalization
6. Excessive bureaucracy
7. Inappropriate incentives for innovation

I could write a book on each of these "seven deadly sins". Rather than elaborate though, I'll let you conduct your own "trial" and move on. Computing services organizations experienced adverse effects as a result of resisting change. Included are loss of identity, shared authority/control, deterioration of organizational image and political complications. Every computing organization was affected by the changes in the computing environment. The outcomes for each varied according to the institution's and computing organization's responses to the change variables.

CHANGING STATUS OF COMPUTING SERVICE ORGANIZATIONS

Several months ago, our computing services organization had an opening for an associate director for the user services area. When the search committee had narrowed the list of applicants down to five, I interviewed each candidate by phone and called their references. These conversations made me aware of the alienation of many computing service organizations across the nation from the schools/colleges and administrative offices on their campuses. While computer service organizations had the technological resources, appropriate facilities and a well-prepared staff, they needed one more thing ---the opportunity to use them!

Can computing services organizations recover their status in the higher education? To answer that question, let's examine the affect of resistance to change by two vendors of computer products. In the mid-1970, I was a consultant to a Title III project that formed a network of secondary schools in South Dakota. We had an IBM mainframe and I wanted to use their hardware and software. However, the IBM 370/145 mainframe could not match the capabilities of DEC minicomputers. IBM had not recognized the minicomputer market at that time. Reluctantly, We chose a DEC

minicomputer and began a statewide project.

The project was successful (at least, to some extent) and continued into the late 1970's when we discovered microcomputers. Again, we encouraged a vendor (DEC) to be responsive to market requirements without success. We replaced the minicomputer with micros from Apple, Commodore, etc. So, what happened to the unresponsive vendors? As you know, IBM belatedly addressed the mini marketplace and came on strong in the micro marketplace. DEC is still trying to scramble into the micro marketplace! Even with the great financial and marketing resources of those giants, it's more difficult to make a market comeback than to be responsive to initial marketing opportunities. Computing services organizations, with more limited resources, are faced with a similar comeback challenge on many campuses!

Technology and facilities are easily managed compared to the computing service organizations most valuable resource, quality staff. Staff resources, however, will be the most critical factor in determining future successes and failures for computing organizations. The computing services organization's staff must be:

1. Responsive to clients needs
2. Promote organizational cooperation
3. Provide positive leadership.

However, if the computing services organization has lost credibility on campus and/or has been distributed across computer user departments, it is almost impossible to accomplish these "to do's" --- particularly, promote organizational cooperation and provide positive leadership!

A couple of years ago, I moved to a university where the computing services organization had lost credibility. The staff, physical facilities and computer resources were adequate but the computing organization was in conflict with many colleges/schools and administrative units of the campus. Survival of the computing services organization into the future was less of a concern than survival at the present! We had a "hill to climb"!

We went to work on user advocacy and responsiveness to clients' needs to slow the "bleeding". However, more direct action was needed to restore the bridges to the university community that had been destroyed. We needed to foster organizational cooperation and to restore Computing Services' leadership status. A marketing plan and promotional effort was needed.

MARKETING CONCEPTS AND STRATEGIES

Most of us in computing service organizations have little training or experience in marketing so they require some research and creativity. From experience, we are aware of advertisements, free trial offers, news releases, newsletters, catalogs, user conferences, annual reports and others. With the help of a few reference books on marketing, our experiential base and faced with a challenge to survival, learning concepts of marketing

concepts are easier to learn!

Let me summarize what we learned. Marketing is a management process of analysis, planning, product/service development and controlled delivery. Marketing is necessary in a "change" environment, depends upon communication of information (promotion), is necessary to assure an organization's future and depends upon the client's needs/wants. There's really isn't much "news" in this summary but a periodic review of marketing concepts could benefit almost any organization!

Our computing services organization's initial marketing efforts met with some success. We were still looking for a way to reach the executive level of the university when one day our idea arrived in my junk mail. That's right ---in my junk mail! As I sorted through the mail in my position next to the wastebasket, I came upon several "free seminar" offers from vendors. The seminars were scheduled in a different city every day and interested persons were invited to attend the seminar of their choice.

Suddenly I realized what a great promotion the "free seminar" was. For a relatively modest cost, vendors got potential customers to give them undivided attention for several hours of sales pitch. Also, the customers paid most of the cost of the promotion by coming to the "free seminar" instead of the vendor sending the marketing staff to potential customers. Out of curiosity let me ask, how many of you have helped some vendor stay within the marketing budget by attending a "free seminar"?

A PROMOTIONAL MODEL

By now you have probably guessed that the next promotion was going to be a "free seminar:"! If I could be lured into a "free seminar" by vendors, then I should be able to get university executives to attend a computing services "free seminar". I tested the idea on one of the vice chancellors and secured his commitment to "sponsor" our Executive Symposium on University Computing (ESUC). Computing Services had a chance to display our wares to the Chancellor and Vice Chancellors. We didn't want to blow it! Our plan for the promotion included these steps:

1. Identify target audience
2. Set promotional objectives
3. Design message
4. Select vehicle
5. Establish budget
6. Select promotional tools
7. Measure promotion results
8. Manage and coordinate

Let's examine the model for the ESUC in a little more detail. Executive level management of the university was the target audience. That's risky and you'd better not do it unless you are prepared to deliver what you are promoting! On the other hand, if support of executive level can be secured, cooperation and support of lower level managers can be more easily attained.

ESUC was a risk that we were willing to take to achieve our objectives!

The next step was to design the message. I formed a team of senior staff members to do that. We selected our best presenters, prepared our message carefully and practiced delivering it in front of the group. The agenda included the following:

1. Welcome and Introduction
2. Institutional Orientation
3. System Integration
    a. Networking/Communications
    b. System Software
    c. Computer Hardware
4. Administrative Applications
5. Support Services
6. Planning for the Future
7. Leadership and Directions

As you can see in the agenda, the ESUC was a marketing effort!

The selected vehicle was, of course, a "free seminar". We were careful to select the time and schedule carefully. I was amazed at how easy it was to get senior executives to attend. Everyone likes something free!

Yes, a budget was needed for the promotion. Pesenters didn't require special funding, but materials and amenities were needed. We wanted to conduct our "free seminar" just like the vendors had taught us!

The promotional tools were designed by the Computing Services senior staff. An associate directors was selected as the coordinator and host. She worked with each presenter to develop materials and then assembled the materials. Invitations, brochures and personal contacts were used to promo our promo! An off-campus site was secured and amenities like coffee and snacks purchased. A packet of all materials was prepared and ready for participants when they arrived.

Measuring the results was one of the most important parts of the ESUC "free seminar". We had the usual evaluation of the presentation. Also, we included an evaluation of campus needs. The "needs assessment" was scored after the seminar and results were sent to each participant to document support for enhancing computing resources. However, the most significant evaluation was a surprise to us. The Vice Chancellor of Academic Affairs asked us to present the ESUC to the Council of Deans. Later, we also presented the ESUC to the Computing Services staff and to the Computing Activities Council.

SUMMARY AND RESULTS

We gave ESUC our best shot and the presentations were well received. In the year since the presentations, significant progress has been accomplished on projects that were identified in the ESUC.

1. A campus-wide computer backbone pr ject is in progress.
2. Writing of a plan for academic and administrative computing is nearing completion.
3. The IBM mainframe computers hardware and software was upgraded.
4. Speci ılized computer systems have been acquired or are in the acquisition process.
5. New computer labs have been created for student use.
6. Workstations have been acquired for some faculty members and administrators and plans are in place to address remaining needs.
7. Plans to improve the administrative information system are in progress (with budgetarv support).

Of course, the ESUC's were only part of an overall marketing effort and a means of informing administrators about future directions for computing on the campus. With all of the projects that are underway now, we may have to let up on the marketing efforts a little so we don't exceed our capacity to deliver. <u>Remember, All You Can Do Is All You Can Do</u>.

I wouldn't want to leave you with misconceptions about how easy all of this has been. Every day is full of new problems and challenges. Don't forget the other book that I referenced at the onset of this paper, <u>How To Swim With The Sharks Without Being Eaten Alive</u>. It has 69 lessons and 19 Quickie observations. I'm in the process of interpreting them from a computing organization's perspective. By the time we meet again, I will have included them in "Survival Skills for Computer Centers In the University of the Future".

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Track II
Managing Technologies Integration

Coordinator:
Diane Kent
University of British Columbia

Management of higher education institutions can be influenced by the integration of technologies; in turn, good management practice must be applied to the task of managing that integration.

Subjects of papers in this track include how the integration of tools such as CASE and Information Engineering affects the way we manage systems development; what new technologies we can incorporate to help manage the scarce resources of facilities, finances, employees, students, instructional and research services, and information; how new technologies can be integrated with older technologies; and how the significant changes wrought by such integration can be managed throughout the institution.

Margaret V. Krol
University of Illinois

Bernard W. Gleason, Boston College

Computing in the 90's
Will we be ready for the applications needed?

Stephen Patrick

Abstract

The decade of the 80's has seen many profound changes in the nature of computing that are slowly being felt in administrative computing.

In the past, the mission of administrative computing was to provide record keeping support to service organizations. In the next few years the traditional applications we use to justify our (high?) budgets will not be seen as a valid reason for spending a significant portion of a university's budget.

For administrative computing management to survive in a position of influence on campus, we must determine what are the important administrative applications for the next decade, and provide them when needed.

INTRODUCTION

The University of Wisconsin - Stevens Point is completing the installation of a campus wide-network. My thoughts now look to the next step in the growth of computing and technology on our campus. Unfortunately, most of the technological leaders are in a similar position.

This paper provides a mechanism for evaluating the potential applications of the next decade. To do this, I develop a model based on Abraham Maslow's theory of motivation. Like all models, this one is subject to oversimplification.

TECHNOLOGICAL ADVANCES DURING THE 80's

In the "good old days" of administrative computing (1970's), computing was centralized and under control. Computing was controlled by a technocracy that perpetuated a mystical aura about computers, programs, and applications. Computing management considered this proper from their perspective. Computing management continually approached upper management to fund an expanded computing mission.

With the entry of the IBM PC in the early 80's, the computing environment changed. Personal computers began to appear across campus and were out of the control of the central computer organization. Computing was no longer restricted to the computer professionals.

Initially, personal computers were single-user computers. You could not perform many useful applications without moving data from one computer to another. Computer networking appeared to provide the solution to this problem. The growth of computer networking was bottom up rather than top down. People began by connecting small office networks. Later they tried to expand them.

SOCIAL CHANGES RESULTING FROM TECHNOLOGICAL CHANGES

Non-technical computer users became self-reliant. Secretaries, Deans, Department Chairs, Accountants, and in rare cases, Executives became knowledgeable about computing. Computing has traditionally provided a mechanism of making the work of an organization more efficient. The micro computer has made the work of individuals more efficient and effective.

There is now a dichotomy between mainframe and micro computer users and professionals. Mainframers think they are doing the real computing and personal computers are toys. Users of micro computers wonder why it takes years to develop mainframe systems when they can do it DBase in days.

In academic settings, the users of computers have changed. In the early days of computing, the main advocates of computing were the sciences. Computers were needed to perform calculations, simulations, or statistical analyses. The micro computer changed this orientation. Now the liberal arts faculty are among the strongest advocates of computers (at UWSP).

HIERARCHY OF NEEDS APPLIED TO ADMINISTRATIVE COMPUTING

The needs of each institution determine the computing applications needed by that institution. I will draw an analogy between computer applications and Maslow's theory of the hierarchy of needs to motivate individuals. Because Maslow's theory is an analogy to describe human behavior, I am making an analogy of another analogy.

Maslow's Hierarchy of Needs

Abraham Maslow, in his book "Motivation and Personality" developed a theory about the motivating factors for people. His theory states there is a hierarchy of needs that motivates people. The lowest unmet need motivates individuals. Once an individual has satisfied the lowest need, that need will not motivate the individual. I briefly describe Maslow's hierarchy of needs from lowest to highest below.

Physiological Needs

> The human body needs food, water and air to survive.

Safety Needs

> Once an individual has satisfied his or her physiological needs, security from uncertainty (freedom from fear) motivates the individual.

Belongingness Needs

> These needs relate to an individual being part of the group and having a spouse/and or children.

Esteem Needs

> These needs relate both to an individual's self esteem (feeling of worth) and the desire for prestige or respect from other people.

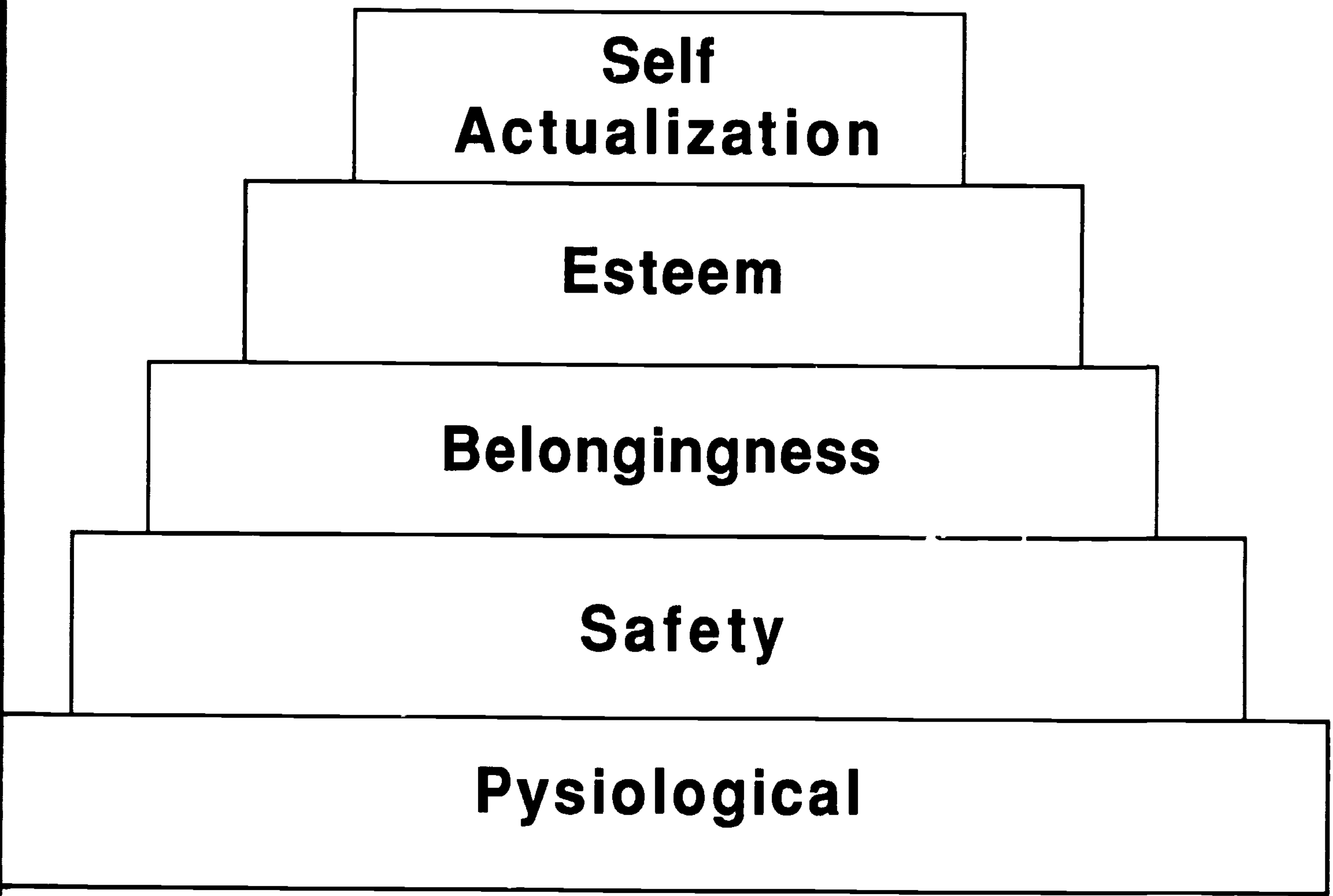
Self-Actualization

> At the top of the hierarchy is the need to attain the highest level of an individual's chosen endeavor of field. To be the best "Programmer" (Mother, runner, accountant, hunter, etc) possible.

These needs are a hierarchy with the higher level needs resting on a foundation of the lower order needs. If an individual's safety needs are unmet, belongingness factors would not motivate the individual. Once the safety needs are satisfied, belongingness factors would motivate the individual. One implication of this theory is that you cannot expect to use a single motivating factor to motivate a group of individuals. Each individual is at a different point in the hierarchy and therefore different factors motivate different individuals.

An illustration of Maslow's theory is to imagine how priorities change in a health crisis situation. One week you are concerned with your next promotion, or how to improve your golf score. If you then were to have a heart attack, your priorities would change quickly. You are now more concerned with survival (physiological needs) than anything else. Once you are over the immediate danger, you may change your lifestyle to avoid a future attack (safety needs). Only after you satisfy these lower order needs, can you return to fulfilling higher order needs.

Maslow's Hierarchy of Needs



In our society, we consider physiological and safety needs lower order needs while the other needs are higher order needs. Higher order needs are positive motivators (carrots). Lower order needs are negative motivators (sticks). To motivate at a level below an individual, you have to threaten that individual. As an illustration, you could not motivate an individual working on esteem needs by offering to satisfy safety needs. You could motivate that individual by threatening to lower the individual to the safety level on the hierarchy. This approach can backfire because the individual's solution to his or her problem may not be congruent with your goals (i.e. to find employment elsewhere). If you motivate an individual at or above that individual's need level you are helping the individual achieve his or her goals. This is the classic win-win situation.

APPLICATION OF MASLOW'S HIERARCHY TO COMPUTING

An example of how this analogy works in computing is to examine a Payroll system. Payroll was one of the earliest computer applications. By definition, this is a low order need. Computer center directors will get few rewards for having a state-of-the-art payroll system. What happens if you are late printing paychecks? The organization will find itself suddenly dealing with its physiological needs.

Listed below are a few of the administrative computing applications and my guess as to where they could be in Maslow's hierarchy.

"Physiological" Applications

- Payroll
- Accounting

"Safety" Applications

- Financial Aids
- Backup and Recovery

"Belongingness" Applications

- Networking
- Electronic Mail

Esteem

- ???

Self-Actualization

- ???

What are higher level applications?

To discover the higher level applications, we should look at the higher level needs of universities.

Esteem

Sports.

It is unlikely that an administrative computer application could significantly improve a university's athletic competitiveness. Keep an open mind for dealing with athletic opportunities. Those that directly support the improvement of a school's athletic achievements will yield rewards.

Nobel prizes.

Obtaining higher quality faculty for an institution appears out of the realm of administrative computing.

Super Computers.

Academic computing got here first.

Image.

Many colleges are in a continual effort to upgrade their image. Community colleges are trying to become four-year colleges. Four-year colleges are trying to become research universities.

Self-Actualization

To become the "best" university possible. This would emphasize one or more specialties of each university's specialties.

PROVIDING THE NEXT GENERATION'S APPLICATIONS

The computer applications that will be important depend on the state of computing and the university in the hierarchy of needs. You must allocate your resources to deal with the appropriate computing problems. Most organizations can only support a limited number of major initiatives. If you place your top priority to filling a need that is either above or below your institution's need level, you will be wasting resources on the wrong problem.

As an example, consider the case of an institution which has fulfilled its safety needs. An appropriate priority project could be either a campus-wide network, or integrating the campus with national networks. If the priority project were to install a new Accounting system, you would find little support (outside of the Accounting office) for this project. This is not to say that it is not important to have an accounting system. Don't try to use the accounting system as an excuse for not fulfilling other needs.

On any of our campuses, we could find a variety of individuals working on different levels. The stereotypical absent-minded professor is clearly at the self-actualization level of Maslow's hierarchy. This is not true of computing in higher education. Computing is a new field that has matured during the lifetime of most of us. Because computing began at essentially the same time for many institutions, we expect similar development patterns. Many institutions are dealing with the same needs at the same time.

If we look at what "leading edge" universities have accomplished recently, we see that the "hot" topic is networking. The Maslow model shows networking as a belongingness need. Leading edge institutions should soon be ready to attack esteem needs, followed by self-actualization.

ESTEEM NEEDS OF A UNIVERSITY

When computers were rare, they were often put on display to meet an esteem need. The computer was just there to increase an institution's stature. We can see this same phenomena with supercomputers and access to computers by students faculty and staff. Some institutions promote themselves based on the number or kind of computers present. Some institutions are requiring all students to purchase computers without evaluating their usefulness (we must be good, because our students need a computer).

Computerization of the faculty, and increasing the access to computers by students and staff is a legitimate esteem goal. We had great success when providing access to computers to a wide variety of non-technical faculty.

SELF-ACTUALIZATION NEEDS OF A UNIVERSITY

These needs involve making a good academic program, as good as it can be. I would consider making a mediocre program better to be an esteem need. Each university has one or two specialty academic programs. Direct support given to these programs will help the institution reach its self-actualization goals.

STRATEGIES FOR SUCCESS

Before developing strategies, you must determine the institution's position in the hierarchy of needs, and computing's position in the hierarchy. If the institution's position in the hierarchy is below computing's (hopefully a rare occurrence), find a new job because you will not get resources to accomplish any of your goals. If the institution is above computing's level (the most common situation), you must bring computing up to institution's level.

In developing strategies, be aware of the differences between positive and negative motivation. Your role will be to motivate top management to allocate resources to accomplish computing goals. You may be able to use negative motivation occasionally. Negative motivation, if overused, will motivate management to find a replacement for you.

CATCH UP

As previously stated, leading edge institutions have solved networking. If your computing is at a lower level, you are in a catch up situation. You have the option of doing nothing, which may be successful but is not interesting. Catching up is not difficult because other institutions have overcome the "leading edge" problems. Purposely trailing the "state of the art" far enough to avoid mistakes is a common strategy (followed by IBM). Networking is mature enough that the most conservative institution can succeed.

Your problem is more difficult if your basic administrative applications are not in order. In this case, you may not get good long-term support for solving these prolems. The best solution for this would be a quick fix (purchase a turnkey application). This places the implementation of the application in the hands of the user, and an outside vendor. With this strategy, you may still have resources to attack higher level problems. You would then emphasize the higher level problem, and downplay the lower level problem. This situation may require negative motivation to get the resources to do the job. If you do, try to get all the

resources you need committed once. You will have a very difficult time if you must repeatedly return for additional resources.

LEADING EDGE INSTITUTIONS

It is very difficult for leading edge institutions to predict where technology is taking us. We should be striving to help the institution achieve its esteem, and self-actualization needs. Look for opportunities to support athletics, and provide direct support for programs that are good and aspiring to be great.

Many of these applications appear to be in the domain of Academic Computing. Examples of administrative applications supporting higher level needs include recruiting, library applications, authoring and document preparation. A rule of thumb is to provide applications that directly support individual faculty members.

WHAT'S IN THE CRYSTAL BALL?

Up to this point, we have looked at campus needs, not technology. I do not pretend to be a technology forecaster, but a look at technical trends and current problems may give us an insight into the technological advances that should appear.

The IBM PC operating system (MS-DOS) has not been able to keep up with the advances in computer hardware. The architectural limitations of MS-DOS, 640 thousand bytes of memory, 32 million bytes of disk storage, and the 16 bit data path are major hindrances when memory is in increments of 1 million bits, and a 3 inch laser disk can contain 500 million bytes of storage. Parallel processor desktop computers can be mass produced at a cost comparable to current PCs. Unfortunately, we do not have an operating system or application software to take advantage of the computing power now available. Someone will solve this problem which could revolutionize personal computing.

Inexpensive mass storage will have an impact on many aspects of computing. Optical disks the size of a floppy disk can store 500 million characters of information. These units are used in library applications (periodical indexes), and in some database retrieval. We should look for optical disk technology to continue to advance with ever lower prices. This may provide new opportunities for information distribution. A significant portion of the cost for information dissemination is the cost of media (paper and ink), and transportation. With these costs reduced considerably, information dissemination will accelerate.

Artificial intelligence(AI) has been a popular buzz word for several years now without any tangible results. The problems with AI are that it takes horrendous computer resources to run AI applications, few people know how to program AI applications, and few of us can identify good candidates for AI applications (other than Financial Aid eligibility). We should expect to see an easy to use AI system that runs on a low cost "super" personal computer. If this system is good enough, it could sweep past the MSDOS generation and establish a new standard for personal computing.

Communication standards should finally arrive. This will mean that all computers will be able to coexist and perhaps even communicate with each other on the same network.

CONCLUSION

The era of the COBOL mainframe computing center is coming to a close. Traditionally, administrative computing was a service organization serving other service organizations. In the next decade, administrative computing must continue to be a service organization, but must transition to provide direct support of the institution's mission at all levels of the hierarchy of needs.

Glasnost, The Era of "Openness"

Bernard W. Gleason
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Chestnut Hill, Massachusetts

November 29, 1988

The demand on college campuses for access to administrative information by a broad range of the community — faculty, staff and students — is quickly becoming a network service requirement similar to electronic mail. The need for "openness" has been slow in developing primarily due to the natural divisions between academic and administrative computing and the serious security considerations.

This paper will discuss an overall systems architecture that will provide a platform for universal access to administrative systems information by all members of the university community. Special emphasis will be placed upon the unique security techniques, and a common presentation across all systems, voice as well as data.

Glasnost, The Era of "Openness"

by Bernard W. Gleason

We are in an era when progress will be shaped by universal human interest.

M.S. Gorbachev

Glasnost is a word in Soviet society that is commonly used to mean "openness." *Glasnost* is based upon the principle that citizens can enjoy their rights and freedom as long as the exercise of these privileges does not prejudice or jeopardize the interests of the society.

On our campuses, we are experiencing trends, such as the proliferation of networks, the rapid permeation of workstations, the integration of voice and data communications, and the emergence of the library as an information utility, that are accelerating the convergence of the academic and administrative sectors. At many universities, this thawing of cold war relationships has lead to a restructuring of the campus computing and communications society. In many cases, this on-campus *perestroika* has been carried out through democratic decentralization of computing. In other instances, reforms have been accomplished through open and cooperative computing, including access to administrative information.

At Boston College, we have followed the latter model, and have adopted a policy of broad and open access to all administrative information systems, including the transactional systems. It is our intent to provide all members of the University community with open access to information. This will improve information sharing among faculty, staff, students and others as well as provide higher levels of office efficiency and reporting across the campus.

Of course, this statement of intent raises a number of policy and security issues, and the resolution of these issues is apt to dictate the rate of implementation. In the application of the Soviet policy of *Glasnost*, it is likely that the government will reserve the right to control and regulate the move toward openness, and reform will come through evolution not revolution. The move toward providing broader access to administrative information is a process that has been going on for many years and, in fact, it is a strategic direction that has been under consideration and refinement at Boston College for over a decade.

In 1987, about the time that Mikhail S. Gorbachev espoused his doctrine of openness, the ideas that had been guiding the development of open administrative systems at Boston College were being formally organized into a set of concepts and guiding principles. The underlying premise of these concepts recognizes data as primary, technology as secondary and the building of a knowledge base as paramount. We will continue to see changes in hardware and software tools but the data requirements for completeness and consistency across all systems will remain constant.

For years, many of these futuristic notions of openness were routinely ignored by users as pipe-dreams and unnecessary overhead. We are now witnessing the emergence of new technologies and changes in the campus society that will greatly facilitate the turning of these concepts into practical applications. The realization that many of these dreams are about to come true has prompted the publication of this document.

Conceptualist's View of the World

Administrative managers and systems designers are often viewed as the campus politburo, a group of staunch old bureaucrats who are tied to obsolete technologies and are more interested in retaining control than sharing information. In reality, the fondest dream of every information systems manager is to apply positive change to the way that the institution will function, and every information systems manager is constantly conceptualizing and redefining the campus information model.

The conceptualist's or dreamer's view of systems should be distinguished from that of the strategist. The strategist may develop a plan covering many years including a statement of goals, objectives and the means to achieve the objectives. The statement of concepts is a formal document that contains a general set of principles but is not time dependent; the rate of implementation is governed by the availability of the technological tools and general compliance with strategic plans. This set of concepts is also subject to revision when the next good idea comes along.

At Boston College, systems planners have based judgements on a belief in long-term solutions. The user community has come to expect quick solutions and is being provided with more and better tools to implement these solutions. In this environment, it would appear that the conceptualist would have a difficult time functioning and monitoring compliance with principles. In addition, the visionary seed planted by the conceptualist may take many years to yield a practical application product, and the systems development group, as well as the user community, may not be enthusiastic about doing all the required groundwork if the effort may not have apparent near-term impact.

By the time a concept becomes a product, the individual who had the original notion may have left the institution or the principle may have become so universally accepted that the identity of the source of the idea has been lost. We all get satisfaction from a sense of a job well done but the conceptualist may never get the recognition. For example, in the early 1970s Boston College recognized the need for an automated library system and the future role of the university library as an information utility providing open access to the community and beyond. Even though we didn't have a specific plan or date when the automation of the library would take place, we began the retrospective conversion of the card catalog into machine-readable form. In 1981 in our Request For Proposal to vendors, we were able to state requirements for support of an on-line catalog in full MARC format. Vendors were astonished to discover that the conversion of nearly one million volumes had already been accomplished.

In 1982, the library system was implemented and in 1983, we moved into the new Thomas P. O'Neill Library without the card catalog. The on-line catalog became a showpiece for Boston College. It wasn't until knowledgeable visitors began to ask, "Are you telling me that the total collection is on-line?" before campus administrators began to realize the significance of the conceptual vision. It was only then that the individuals who conceived the idea could experience some sense of job satisfaction. But the process is never ending and we are now poised to apply a whole new set of concepts that will make it even easier to access library materials.

There are many other examples of the application of concepts, and the unfolding success of the *Glasnost* project is a tribute not only to the foresight of certain individuals but also to the dedication and the discipline of the systems developers which has guaranteed adherence to the concepts.

Information as a Free Resource

The development of the library system did not end with the retrospective conversion of the card catalog and the implementation of the on-line system. A whole new set of

concepts began to be developed, and currently Boston College is engaged in projects that will provide access to large number of information databases and external information services over the campus network. It is conceivable in the not too distant future that expert systems will provide users with an intelligent interface that will provide help services similar to those supplied by a reference librarian. It is also easy to envision the day when a user will have access to full text retrieval capabilities. For example, if I was researching this topic, I may have performed a simple search through all available text looking for all instances of "Gorbachev's policies of *Glasnost* " and retrieved all the appropriate passages.

The future of the library as an information utility extends beyond the existing boundaries and the notion of the library as a free resource to find information applies equally to administrative systems information. The same methods are used to access both administrative and library information and there are no charges for service.

Establishing Authority Control

In any discussion of access to information there is usually a debate regarding the granting of authority to retrieve data. In most instances, operational information flows across the University from department to department in a horizontal manner and is not restricted by organizational boundaries. On the other hand, authority to access management information tends to be vertical and the routing of the information and the permission to access the information passes up through the hierarchical organization structure. The information systems manager is often placed in the position of seemingly not providing the desired information and not having the authority to take corrective action.

Offices who have custodial responsibility for data are not usually reluctant to release information to proper recipients but there is a genuine concern for misuse. This concern often leads to the custodial department releasing a limited amount of information on a periodic basis and establishing a procedure to review all requests for additional information.

Compounding this dilemma is the inaccurate reference to the top computing position as the Chief Information Officer (CIO). The information systems manager is responsible for the management of the computing and communications facilities and the design of the systems but has no authority to create, modify or distribute information. Perhaps, a more appropriate name should be Chief Computing and Communications Person and, for emphasis, he or she should wear a jersey with CCCP emblazoned across the chest to help identify the true role.

The real information czar on campus is the Chief Executive Officer. At Boston College it is our intent to provide executive management with accessibility to every possible piece of information, except data that may violate the confidentiality of individual's records. The means for providing this information is through an Executive Information System (EIS) that uses all of the features described later in this report. In this environment, any political issues relating to access to information are handled outside of the information systems organization, with executive management providing the authorizations. Using this approach means that the information systems manager needs to provide the information and maximum flexibility and worry about the application of distribution authority at a later time.

Data Management and Integrity

While the term "centralized" may be viewed in campus political circles as a dirty word, centralized planning is a key factor in the design of a campus-wide system that will support the concepts of *Glasnost* . Centralized management of the primary knowledge database is necessary to provide the high degree of referential integrity needed to ensure the

validity of shared data. This strong statement of data management applies whether or not the environment is distributed, and the distinction between planning, management and control is very important. Control belongs to the users, planning is a joint effort, and management of the environment is a responsibility of the information systems staff.

At Boston College, we have developed an integrated systems architecture that provides a platform on which to build all applications and enables campus-wide data sharing. These systems can be characterized as interactive, integrated and highly standardized. The application of standards includes screen formats, program structures, naming conventions, data definitions and access codes, resulting in a consistent"look and feel" across all systems.

The conformity to standards and a single architecture has provided some obvious technical benefits but it has also furnished a base for providing a true end-user computing environment characterized by ease of access and intuitive interfaces. In the true end-user environment, all transactional data and information is entered directly into the system by the originator, not some intermediary. For example, professors can enter grades directly into the system, students can register for courses, advisors can retrieve degree audit information, chairpersons can prepare course descriptions, and the list goes on, and the extent of the capabilities is only limited by the designer's imagination. Many of the examples cited above may require automated approval procedures but they are all illustrations of the reduction of clerical tasks in the Registrar's Office and the elimination of the manual transmission of paper among parties.

Intuitive Representation

Many computing and communications interfaces gain the label of "intuitive" not only because of the so called "ease of use" but also because of the acceptance that commonly used interfaces have gained through broad exposure. For example, the telephone has been an accepted medium for a long time. Western society has now embraced a variety of interactive devices, such as voice response units and ATMs (Automated Teller Machines), that weren't even a consideration for broad public use a decade ago. In the last couple of years, the quick acceptance of graphical interfaces by the user community has been recognized and promoted in the computing industry as the future of man-machine interaction. In the next few years, we expect to see interfaces with expert systems capabilities that will allow even the most unskilled individuals to easily interact with systems. At Boston College, we have adapted the systems architecture to accept these "real world" solutions and to be positioned to embrace the impending flow of application tools that will support voice technology and graphical interfaces.

In administrative systems, graphics have long been a desired means of displaying report information, and as mentioned, the graphical front-end is emerging as the common user interface. The missing piece is the storage and management of the knowledge base in graphical form. For instance, when we think of a building, we visualize a floor plan, not room numbers, square footage, coordinates, etc. in data form. The common user image of organizational charts is a hierarchical structure in graphic form, not departmental account numbers and names linked together in a database. Individual students are recognized by facial image, not a social security number. The campus network is commonly represented as a topographical view of cables and conduits layered on the campus and building blueprints. In the past, systems designers have chosen to shortcut or avoid the automation of these graphical databases for a variety of reasons most notably, the memory and storage requirements and the limitations and/or costs of workstations.

In its simplest form the University is composed of a set of buildings and a collection of positions that are occupied by individuals who teach, conduct research, answer telephones, operate computers, etc., and these fixed components of buildings,

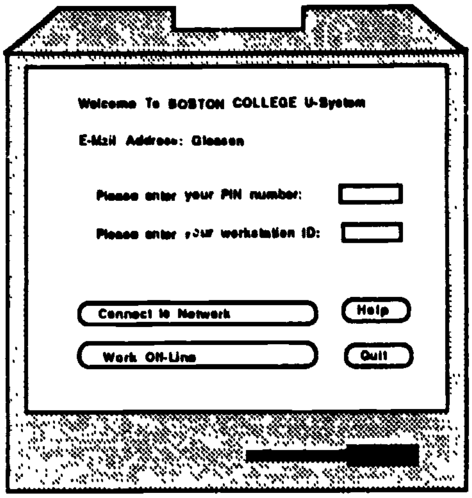
departments and positions are the principal database design components. Designers of university information systems have traditionally advocated the implementat ı of Student Record and Financial Accounting Systems as the primary building blocks an. including limited data tables for the fixed resources within those systems. These two application systems are certainly the most important from an operational standpoint but are secondary in the design of the total integrated system.

Hype vs. Reality

Brian Hawkins, the Vice President for Information Systems at Brown University likes to apply what he calls the "hype/reality index" to presentations. At Boston College, most of the features described in this paper are already operational or there is an active plan for implementation over the next year. Most importantly, the single systems architecture, the single security system and the data requirements are all complete. The hard work is all done, and as new vendor offerings become available, we will simply attach the appropriate services to the system.

We are front-ending the current data systems with a variety of easy-to-use interfaces. It is our strategy to concurrently support microcomputer access with graphical interfaces that provide terminal emulation and a client/server relationships. It is our expectation that the structure and location of the target database will be less of an issue and that there will be a continuing migration toward a client/server environment. The user interface and the data requirements will remain constant but the residency of the data and the communications capabilities will change. One of the first steps will be to distribute application access and security down to the server level. The security routines will need to be more than the common log on, password procedures.

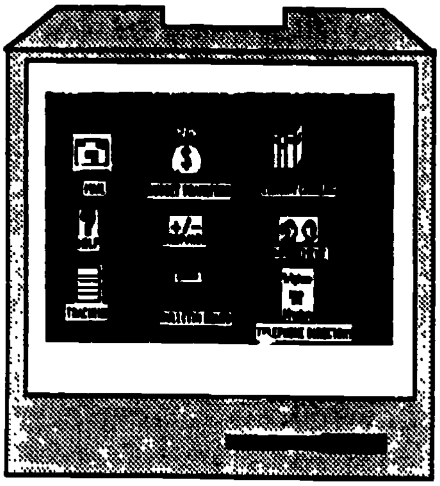
COMMON LOG ON



The information system has been designed so that the user views a single system that is customized to the individual users needs with the appropriate functionality, instead of a series of seemingly independent application systems with separate log on procedures for each system. Users are presented with a common user interface across all systems and computing environments, and users interact with a consistent sequence of log on entries. This common log on sequence applies to access by telephone as well as workstations.

After logging on to the system, the user is presented with a menu of functions. The operator establishes a dialog with the system that states the desired functions immediately without needing to select an application system, signing on to that system and stepping down through a menu structure. In addition, users view the system as a single system and they can move from one function to another without logging off and logging on application systems. This function-based menu approach also provides the user with transparent access to data, thus eliminating the need to know where data is located. These function-based menus are customized by associating an individual with an access classification (faculty, staff or student) and providing an appropriate portfolio of functions.

FUNCTION BASED MENUS



The portfolio may contain a variety of software resident on workstation, server and host environments. The establishment of software standards at all levels facilitates the ease of cooperative processing in a transparent mode. For example, the user may create a mail message by composing the memo on the workstation and only attaching to the network when the user wishes to send the memo.

The pointing and clicking on a function will create another window with a set of menu functions.

The function based menus are designed primarily for the uninitiated users; they do not preclude access to application systems using traditional terminal applications. In fact, many high volume users will continue to operate in a locally attached mode with a fixed function workstation in order to attain maximum productivity.

Security

When the provision of open access was first discussed at Boston College, the immediate concern was security, the absolute protection of data and the confidentiality of information. Secondary concerns were the provision of adequate computing and communications capacity, the incompatibility of various terminal devices and keyboard devices. Lastly, the major administrative question was how to maintain the individual security profiles of thousands of individuals without expanding the security administration function to the equivalent of an on-campus KGB? The resolution required some ingenuity and resulted in a novel approach of assigning security to job positions, instead of individuals, and adapting the production data system to control the security system.

At log on execution, users are allowed to gain privileges in one of five ways:

1. by groups or classes to which they belong, i.e. faculty, staff and students;
2. by responsibilities associated with specific jobs;
3. by individual (access to their own records);
4. by data dependency; or
5. by organizational structure.

At the time that an individual logs on to the system, the system applies the rules and develops a set of user profiles. The security facility will then map all of the appropriate profiles together so that a composite of the individual's privileges is recalculated at the start of each session. At the time that an individual becomes associated with the University or changes status within the University, their personal information is entered into the system (Human Resources or Student Record Systems) which automatically alters the individual security profiles that are associated with the individual. The person's personnel and/or registration records determine the individual's group or class assignments.

The Human Resources System contains a position control function. As individuals are hired, terminated or change positions, the system automatically assigns position-specific attributes, such as office location, telephone number, job title, etc., to the individual. In addition, the system assigns the security profile associated with the job. Individuals may hold multiple jobs or may attend classes as well as be employed.

Individuals have access to their personal records. This is strictly a one-for-one relationship. For example, a student can access his/her student account, financial aid, grades and other records, employees can access their own personnel, payroll, and student records.

Individuals also have access to records based upon the data that is resident in records in the production systems. For example, a faculty member has access to records of individual students for advisement based upon the registrar's designation of the faculty member as the advisor in the student's record.

The hierarchy of departments and positions is defined within the system and individuals, by virtue of occupancy in a position, may have access to information that is available to individuals in positions lower in the structure. For example, access to budget information for a grant in the Biology Department is provided to the principal investigator by virtue of his/her job responsibility. The Dean of the college, who may be seven or eight levels up in the hierarchy may not be directly responsible for the budget but would have authority to access the budget information using a workstation or telephone voice response.

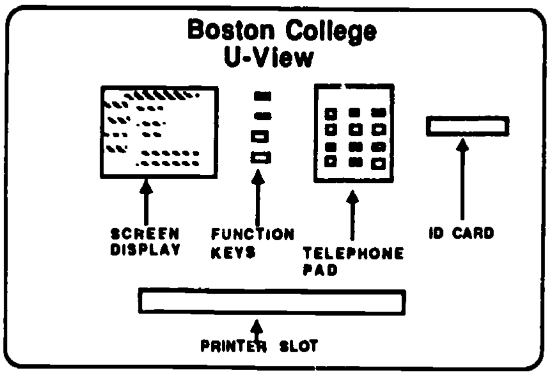
Access Methods

The provision of wide-spread access builds upon the existing architecture and protects the current investment in information systems. The design also recognizes the realistic provision of access devices and the current configuration of communications capabilities. At Boston College, like most campuses, there are a variety of existing terminals and microcomputers in offices with varying communications capabilities. The one constant is the telephone.

The system design permits the access to information from multiple device types. In cases where the telephone is used to interact with the system, the application is designed to function the same on all platforms, with the telephone keypad being the lowest common denominator. We refer to this design as RISK, or Reduced Instruction Set Keyboard, technology. An example of this type of application is student course registration drop/add. In this application, the user is restricted to numeric entries (i.e. social security, PIN number, course numbers, and selection and response keys) and function codes (i.e. star and pound signs). The terminal operator in the Registrar's Office with a full-function keyboard would use the same limited keyboard functions and numeric entries, and the same would be true for a student processing the transaction using an ATM-type device.

In the open society, there are no borders and curfews, and the lifestyles of students are not synchronized with the standard, Monday through Friday, 9:00 to 5:00 office hours. The servicing of students in the library and public computing facilities and normal access to computing networks is now a seven day/24-hour proposition. Students will utilize the services of the network, not only for course work, but also to access administrative systems, similar to the way we now conduct our banking business.

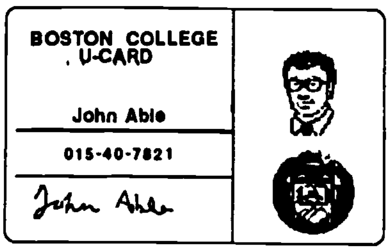
ATM ACCESS

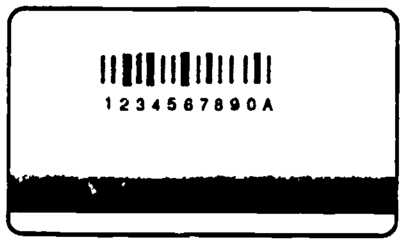


Students have the ability to conduct business with the administrative offices of the university any time of the day through the use of devices similar to ATM machines used by banks. The interface (log-on sequence) is consistent with all other devices and utilizes the single security system. In this case, the university ID card functions as an additional security identifier.

Unlike the common banking ATM device, this machine/terminal does not have a cash function. It does have an eight inch printer, and students can retrieve a variety of information from the Student Record System. For example, students can check to see if their student loan has been processed; they can drop and add courses, they can retrieve a revised class schedule in printed form; they can read electronic mail messages.

UNIVERSAL ID CARD



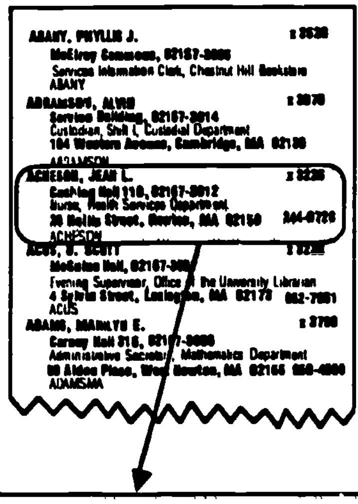


As soon as an individual is identified through the transactional system as being associated with Boston College as an employee or student, the system automatically generates identification information. Usually the first action of a new student or employee is to obtain a University ID card. This card serves as a passport that has universal usage across campus.

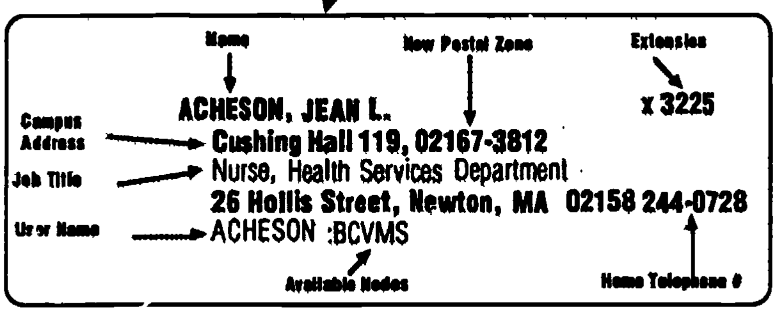
The system automatically generates a unique username, password and PIN (personal identification number) for each individual. The system automatically generates a letter that includes the user's identifiers, voice and data privileges, and operating instructions so that the individual can begin accessing the system on the first day of eligibility.

The system can recognize individuals not only by username, PIN, and password but also other identifiers, such as name, social security number, ID card bar code and ID card magnetic stripe. In addition, the system is designed to allow retrieval of an individual identity through departmental directories or by pointing to graphic representation of a building floor plan or an organization chart and determining the occupancy of the cell.

CAMPUS DIRECTORY



Identification information, security profiles and demographic data for all individuals associated with Boston College is stored in a single file that forms the basis for directory services functions. The campus telephone directory is extracted directly from the system just prior to publication. This directory is also available on-line in all computing environments as one of the standard menu functions.

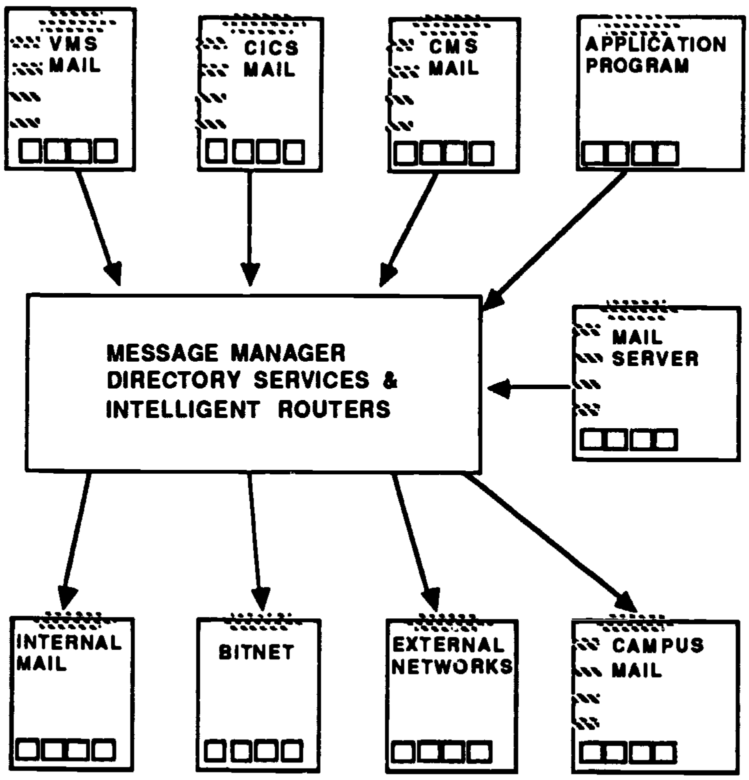


Built into the transactional systems are intelligent routers composed of a set of tables maintained by custodial user departments. These routers allow a user to execute mail or forms routing transactions without stipulating the receiving party or parties. The designation of recipients is determined at execution time by associating tables of positions with individuals and making an assignment. An example of the use of this capability is in U-Buy, the campus-wide on-line accounts payable/purchasing system, when a user issues a purchase order, U-Buy knows who to route the form to for an electronic signature.

The system uses a similar type of mechanism to provide the user with transaction generated messaging. The theory is to have intelligent agents that know "who should know what" and automatically trigger messages based on an activity. This feature alerts individuals on a timely basis rather than requiring the user to execute queries. A possible example of this facility would be automatic generation of a message to a professor alerting him/her to a student's withdrawal from a course taught by the professor. Another example would be the generation of a message that would alert management through the Executive Information System (EIS) of exception conditions.

Individuals can also initiate mail by addressing the message to a group and utilizing automatic distribution capabilities. For example, a professor could address a class assignment to all students enrolled in a course as long as the system determined that the professor issuing the memo is also the instructor. If authority is granted, the system would use the class list to determine the students and the corresponding directory entries to determine the appropriate routing schemes.

MESSAGE ROUTING



The system will accept messages and forms from different computing sources and a single routing scheme will be utilized for distribution of all messages and forms. Users who do not have an electronic address or do not read messages within a prescribed time limit will receive a printed copy automatically through campus mail. All of the computer-generated campus mail is pre-sorted in accordance with the filing scheme in the campus post office.

The electronic and paper campus mail facilities are integrated with the voice mail system so that users are alerted to entries in their voice mail boxes from the electronic system and vice-versa. When a user provides a PIN number to the telephone system for long distance access, it is the same PIN number that is used when logging on to the data system, and telephone access security and privileges are managed by the same security routines and techniques.

Users can also access administrative systems information through the use of a touch-tone phone. For example, a department manager can check on the status of a budget by entering an authorized account number, and prospective students can check on the status of their applications. The system supports both stored and synthesized voice applications, and the selection of the appropriate technique is based upon the audience. The time spent on the phone checking the status of an item can be extremely frustrating. All systems at Boston College have been designed with date and time stamp functions so that users can perform status checks using either voice response or workstation access.

The integration of voice and data technology is put to best use in the servicing of the large community of users. Despite the ease-of-use of systems, the dispersion of access to a

vast audience results in a significant increase in support requirements. At a help desk the incoming phone number can automatically trigger a profile of the user and associated computing and communications hardware and software components. The problem resolution may result in the automatic forwarding of the call and/or screen image.

The key ingredient is a completely integrated system that manages not only the information in administrative data bases but also the computing and communications resources, including workstations, software, and network cable plant and connections.

Glasnost, A Time For "Publicity"

While *Glasnost* has been widely accepted to mean openness, the literal meaning of the word is "publicity." The time has come to publicize the benefits of open administrative systems. While thousands of hours of effort have gone into the design and implementation of production systems that have serviced functional departments, it is not uncommon for a minor, but sometimes visible, element of the system to gain attention and applause.

More importantly, the provision of open access to the masses has a high impact. In the past, access to information has been reserved for a relatively small number of administrators. Reform is now upon us and it is time to service the proletarians, the unpropertied class, our students and other members of the community.

Boston College
Doctrine of *Glasnost*
Concepts and Guiding Principles

Systems Architecture

Administrative systems must be completely integrated to allow interactive data sharing as though there was a single system.

All members of the Boston College community (i.e., faculty, staff, students, prospective students, alumni, outside agencies, etc.) must be provided open access to administrative information.

All screen displays, report formats, and program code must conform to consistent structures, resulting in the same "touch and feel."

A form must have an equivalent screen that corresponds one-for-one in sequence of data fields and entry. This capability must allow users to view a facsimile of the actual form on the screen during entry.

The design of a database structure must recognize that the relatively fixed components of the University database system provide the primary foundation, and implementation of these system components must proceed areas such as Student Records and Financial Accounting.

Appropriate databases must be maintained in both graphical format and data format.

System security must permit a single log on sequence and consistent user interface across all computing and communications environments.

Users must be provided access to function-based menus, resulting in transparent access to data and the ability to move from one function to another without logging on and off.

Design must support a smooth migration from a time-share to a cooperative processing environment.

Security

Access privilege assignments must be position-based rather than by individuals.

The production administrative computing systems must dynamically modify security access profiles.

A single University ID card must be issued to all faculty, staff and students for use in all functions across campus.

A single real-time directory of all members of the community must be available in all environments and be the source for the campus telephone book and the routing of electronic and campus mail.

The campus directory service must be able to cross-reference individuals by social security, personal identification number, passwords on all systems, ID card bar code, ID card magnetic stripe, and username.

The organization structure and the hierarchy of positions must be able to participate in the determination access levels.

Primary custodial offices must have direct responsibility for security assignments.

Information Flow

The same directory services and routing schemes must be used for the routing of mail, files, and forms.

Electronic and voice mail must be integrated.

The system must have built-in intelligence to be able to determine the recipient(s) and pathways rather than requiring the initiator to stipulate the destination.

Messages must be automatically generated based upon the activity in a transaction. The system must be able "to know who needs to know what and when" and be able to route the message through the mail system.

The system must make automatic adjustments to mailing lists, including mailing and electronic addresses, to correspond to real-time changes in data and/or job responsibilities. It must support the ability for a user to address a message to logical group.

All activities must be date and time stamped to provide ease of status checking across all systems.

All batch system must automatically feed a receiving system without any re-keying of information.

Access Methods

Information must be accessible from any workstation, special device, or telephone.

Appropriate data entry applications must be able to be reduced to a keyboard equivalent of a telephone pad.

A variety of special devices (i.e. voice response units, ATMs) must be employed to provide a high level of access and service.

Access to administrative information must be available beyond normal office hours.

Both synthesized and stored voice techniques must be available for interactive retrieval and modification of data.

The computing environment must be integrated with voice to allow access to information based upon a telephone call.

Academic and Administrative Computing
Are they really merging?

Samuel J. Plice

The University of Michigan

Ann Arbor

Michigan

ABSTRACT

In recent years, it has been stated that academic and administrative computing are merging and that there is no real distinction between them. At the University of Michigan, academic and administrative computing have been placed within a single organization, the Information Technology Division (ITD). From one perspective, it is true that academic and administrative computing have merged. From another perspective, however, it is apparent that while there is some sharing of resources, academic and administrative computing remain distinct entities. This paper provides background on the University of Michigan Information Technology Division, indicating where administrative and academic computing have come together, where separation still occurs, and what the prognosis is for further consolidation. By examining these issues, it may be possible to gain insights into the degree to which administrative and academic computing can effectively merge.

Academic and Administrative Computing
Are they really merging?

I. Introduction

At several of the conferences that I have attended over the past couple of years, the statement has been made that academic and administrative computing are merging and that there is no longer any real distinction between them. At the University of Michigan, academic computing and administrative computing have been placed within a single organization known as the Information Technology Division (ITD). From one perspective then, it is true that academic and administrative computing have merged at the University of Michigan. From another perspective, however, it is apparent that while there is some sharing of resources, academic and administrative computing remain to some extent distinct entities. What I want to do today is to first give you a little background on the University of Michigan Information Technology Division, indicate where administrative and academic computing have come together, where separation still occurs, and what the prognosis is for further consolidation. My hope is that by examining these issues, we can gain some insights into the degree to which administrative and academic computing can effectively work together. My opinions are drawn from the perspective of a large institution. The perspective of a smaller institution may be different, but I hope what I have to say has some relevance.

II. University of Michigan Organizational Structure

The Information Technology Division at the University of Michigan combines administrative and academic computing. Whereas the Director of the Computing Center formerly reported to the Vice President for Research and the Director of Administrative Systems formerly reported to the Vice President for Finance, now both report to the Vice-Provost for Information Technology. This change was in response to an announced objective of the University to take a leadership role in information technology. The Office of Administrative Systems includes the Data Systems Center (DSC), which is responsible for operations, Information Systems and Services (ISS), which is responsible for applications, and Telecommunications Systems (UMTel), which is responsible for management of our telephone systems and our wire and cable plant.

III. Technology Base

The Computing Center operates an IBM 3090-600E and runs a University developed operating system known as the Michigan Terminal System (MTS). This timesharing system was developed over the last 15 years and has provided outstanding service to the University community. In recent years, messaging and conferencing have become the leading applications running under MTS. The network, known as UMNet, is a packet switched network that is X.25 compatible and operates using University developed software.

The Data Systems Center operates an IBM 3090-300E running MVS. Over the last 15 years, virtually all applications have been developed in IMS and share large corporate data bases. We're just beginning the use of DB-2 but expect most of our applications to utilize DB-2 in the future. Other software includes TSO, Roscoe, SAS, RAMIS, ASI/Inquiry for data base queries. We also run a message system that communicates with the MTS message system over the internet. DSC shares an SNA network with the University Hospital which also operates an IBM 3090-300E. An IBM 9370 located at DSC serves as a gateway between SNA and UMNet.

Telecommunications Systems (UMTel) operates two Northern Telecom SL-100 circuit switches, one of which has been upgraded to SuperNode status. UMTel installs and manages all twisted pair wire, cable, microwave, and optical fiber. UMTel also provides support for LANSTAR packet switches running Banyan Vines, Appletalk, or Novell network software. Phonenet and twisted pair ethernet installation is also provided by UMTel.

IV. Budget History

Since the creation of ITD, the budget has grown to $54,700,000. Of this, UMTel comprises $20.9M, or 38%; the remainder of OAS is budgeted at $12.6M, or 23%; the Computing Center is budgeted at $11.6M, or 21%, and the remainder of ITD is budgeted at $9.6 M, or 18%. Central funding for OAS has grown from $1,713,000 in 1984 to $2,544,000 in 1989, an increase of 48%. The central allocation for academic computing, including the Computing Center, over the same period has grown from $2,761,256 to $13,344,621, an increase of 383%. As can be seen, administrative computing has not received the influx of central support for operations that academic computing has.

Because of a recent joint agreement with IBM, about which I'll talk in a minute, the DSC mainframe was upgraded from an Amdahl 5860 to an IBM 3090-300E at a cost to DSC of about $500,000. This relieved DSC of a significant capital expenditure in 1988. The money that would have been used to make a down payment on a mainframe was used instead to equip OAS with microcomputers. This represents a major one-time influx of resources to DSC resulting directly from the ITD joint agreement with IBM.

V. ITD Information Technology Strategy

The University envisages a network centered, workstation based, server enhanced multi-vendor strategy. Although the technology expected to be employed throughout is not fully known, some of the details are beginning to fall into place. Much of this comes about because of two major vendor relationships. In August, the University and IBM announced that they would work together on an Institutional File System (IFS), aimed at making the large IBM mainframes act as file servers on the institutional network. In September, the University and Northern Telecom announced the installation of a comprehensive fiber backbone network for the Ann Arbor campus.

Local area networks will be interconnected via fiber using FDDI and TCP/IP protocols and will download shared files from the mainframe file servers developed under IFS. OS/2, Apple, and Unix workstations will be supported. The three IBM mainframes and their disk storage will be accessible via the fiber, making physical location of the data or of the hardware transparent. Access to outside information resources can be achieved via the National Science Foundation Network (NSFNet), whose operations are being managed on the University campus under an NSF grant. Students living in private residences are expected to be able to connect to the campus backbone via ISDN through the local Michigan Bell Telephone Co. switch and by means of PRA connections to the University's Meridian SL-100 SuperNode.

Administrative data stored in administrative data bases on the DSC computer will not be directly accessible via the IFS. Instead, a pseudo-file will be created using a remote access process to extract data from the IMS data bases. A network based security and access control system will need to be developed to enhance the usefulness of the IFS, although that is not now included within the IFS project. We expect to mount efforts directed toward the use of a "smart" card or perhaps the use of the kerberos system developed at MIT. Since the University has 16,000 full time faculty and staff, 35,000 students on the Ann Arbor campus, and an additional 15,000 part time employees, a network of over 30,000 workstations must be supported. Electronic communications with other campuses, supercomputers, and networks will be achieved via NSFNet, which is now managed on the University of Michigan campus by MERIT, the Michigan higher education packet switched network.

VI. OAS Information Technology Strategy

The Office of Administrative Systems, having developed all of its systems using IBM technology, expects to continue doing so, and will implement a large piece of the Systems Application Architecture (SAA). It is anticipated that a great deal of the processing will be done using OS/2 workstations communicating via SNA. At the same time, OAS must recognize the IFS and be prepared to communicate with OS/2, Apple, and Unix-based workstations using TCP/IP protocols. A 9370 processor on the SNA network serves as a TCP/IP gateway. Many new applications will be developed using DB-2, IBM's relational data base product, and a great many systems will continue to run under IMS, IBM's hierarchical data base product. OAS also supports a large but diminishing Wang network, as well as a small but growing population of Banyan Local Area Networks. Protocol emulation provides 3270 access to the administrative mainframe via the Wang systems, Banyan servers, or UMNet, the academic asynchronous network. TempusLink is the product that enables downloading of data from the mainframe to microcomputers. Ad hoc data inquiries or batch listing can be made using ASI/Inquiry and the data can be moved to the microcomputer hard disk via TempusLink.

VII. Areas Where Sharing of Resources Has Occurred

For several years, OAS has had a planning function in place. Originally, this staff was engaged in planning for the development of large shared data bases. In recent years, their charge has expanded to include assisting administrative and academic departments in planning for increased use of computers. The scope of this group has been expanded again with the creation of ITD to include planning for academic use of computers and well as administrative use. This group, now called the Departmental Planning Team, includes persons from both the Computing Center and OAS.

Recently, ITD undertook to support LAN activity. The supported networks are Banyan Vines for IBM PC's and compatibles and AppleTalk for Apple machines. Twisted pair wire is the transport of choice for all local area networks, including PhoneNet, twisted pair ethernet, and LANSTAR. The Committee that did the initial investigation of LANs was a joint Computing Center-OAS committee, and the support staff in place now consists of both Computing Center and OAS personnel. UMTel is heavily involved in establishing these connections. UMTel also installs and maintains all inter-building and most intra-building twisted pair, cable, and fiber networks. The UMTel twisted pair wire is also used to connect workstations to UMNet, the campus packet network. About 6,500 data connections have been installed by UMTel.

Most microcomputer support is provided by the Computing Center. Staff are available to help users with hardware, operating systems, and applications software. Most microcomputer training is done by the Computing Center. OAS does some training in microcomputer usage, concentrating on applications specific to administrative users. For example, administrative users tend to use Office-Writer for word processing whereas academic users tend to us MS Word. The Computing Center supports only Word, therefore OAS must support Office-Writer.

The area where the most sharing occurs is in the network. UMTel provides the transport for most computer networks on campus. UMTel and Computing Center personnel worked together on designing the fiber backbone network which UMTel installed. Gateways between the Computing Centers packet switched network (UMNet) and OAS's SNA network use TCP/IP protocols to achieve file transfer and messaging. However, administrative users tend to use commercially supported communications software while academic users rely on communications software developed by the Computing Center. Users who use both mainframes heavily do not use gateways but have the ability to attach directly to either network. Administrative users tend to use IBM PC's whereas academic users tend to use Apple, Sun, or Apollo microcomputers.

VIII. Barriers to Greater Interaction

I was asked by the CAUSE program committee to talk about barriers to greater interaction between academic and administrative computing. I find myself unable to say much about that because I see little justification for additional interaction, at least in a large institution. If you break the subject down into its individual components, very little commonality can be found:

- Architecture. The academic computing center has the primary responsibility for putting in place the architectural platform on which faculty and students can build their applications. This architecture is evolving into one that facilitates the use of very powerful workstations used individually or in small work groups, generally doing large amounts of processing on small amounts of data. It is specifically designed to facilitate a multi-vendor approach.

  The administrative computing emphasis is on shared applications which operate on a very narrow architectural platform. This architecture facilitates high volume repetitive transactions used commonly by many users. It is most often designed specifically around IBM technology.

- Hardware. Most administrative computing centers do use IBM mainframes. Many academic computing centers do as well, but there are many that use Vax machines and some are running vector computers as well as linear processors. There may or may not be commonality in hardware. In large institutions, even where identical hardware is used, more than one machine is normally required.

- Software. Academic computing centers provide software tools for faculty and staff to use as they see fit. These users develop applications usually intended for small subsets of users and often having a relatively short life span. Administrative computing centers provide applications that are part of the control systems of the institution. They must run reliably and predictably. These applications are shared by many users and typically stay in place for many years. There is little commonality in software.

- Security. The integrity of the corporate data bases, and the privacy of individuals about whom we keep records, are fundamental concerns of administrative data processing. We use security mechanisms to inhibit free access. Academic computing centers want to make their software tools as available as possible. Security mechanisms are intended only to protect individual files from unintended sharing. Current administrative security mechanisms are too intrusive to be tolerated on the academic side.

- Staff. If both academic and administrative computing is done on the same hardware base, then there may be some savings available from combined operations. However, if all mainframe hardware is located in a single building, there is a much higher risk of fire or other major event destroying all of the campus computing power. Administrative computing centers have large staff devoted to developing applications using commercially available software. Academic computing centers have staff devoted to maintaining and enhancing specialized software tools. While there is some overlap, there is minimal commonality in staff expertise required.

- Management. Academic computing centers tend to be tied in closely to the college's computer science department. Their culture is closer to that of an academic department than it is to an administrative

department. Individuals in academic units set their own agendas; individuals in administrative units follow departmental agendas. Individuals in academic units tend to identify with the technology. Individuals in administrative departments tend to identify with the mission of the department. The result is that there is little commonality in the culture of the two organizations and they must be managed in quite different ways.

- Usage. In the academic computing environment, the user controls the computer. In the administrative computing environment, the system controls the way the computer is used. The academic computing environment has been designed first and foremost as a learning environment. It is designed to require the user to learn a certain degree of technical competency. Second, it is designed to provide the individual user great flexibility in the way that user goes about using the computing tools. Each individual user decides which software to use, what the user interface will be, and what degree of security is required.

  The administrative computing environment is one that assumes very narrow technical competency on the part of the user. It has been designed first and foremost as a reliable and secure system. The system dictates the way the user will interact with it and what functions may be performed. Since the data bases operated by administrative computing are part of the control structure of the University, many constraints are built in to be sure access and use is appropriate to the user's corporate responsibility.

- Networking. Networking is the area where most of the standards work is occurring, and most vendors now support TCP/IP protocols as well as their own proprietary protocols. All networking technologies share common transport media, particulary twisted pair wire, and users want a single network connection to their workstation. It is here that I see academic and administrative computing merging and using a common set of standards for communication.

- Other. There are other differences that tend to be idiosyncratic to a particular campus. Often you find different funding mechanisms in place. One side may charge for service, whereas the other may be subsidized. This makes for far different patterns of use. In some cases, the administrative affairs of an institution may be closely tied to the State or to a Statewide system and this will have an impact on how things are done. For small schools, the sheer cost of the technology may demand a greater degree of sharing.

It is unlikely then, that a common information technology architecture will evolve in the near future. The rigidity of the administrative computing environment would not be appropriate to the academic user. Nor would the academic user be well served by extending the security of the administrative systems to academic computing tools. The result is that there will be boundaries between the two environments. The task, then, is to make these technical boundaries as unobtrusive as possible no matter what the organizational boundaries.

IX. How To Make It Work

Whether we agree with it or not, there seems to be a trend toward combining administrative and academic computing under a single organization. I certainly haven't done an exhaustive survey on the subject, but this trend seems to be occurring in the Big Ten institutions, and in some others across the country. For those of us who work in administrative computing this change may not always be welcome. First of all, it may not be welcome because it is change and most of us are basically uncomfortable with change. Second. we see little commonality of mission as I have already described. And third, these combinations almost invariably wind up under the office of academic affairs rather than administrative affairs. Leaders of such joint organizations receive approbation according to what they do in support of research and instruction, not according to what they do for administration. As a result, there is a concern that funding will be directed to academic computing and away from administrative computing. As I have already shown you, administrative computing at the University of Michigan has not benefited as much as has academic computing.

The more pervasive information technology becomes on the campus, the more demands there are for service from the administrative computing organization. Expenditures for information technology on the academic side of the house invariably lead to increased demands on the administrative side of the house. This occurs particularly in the demand by academic units for making mainframe data available to the workstation. Meeting this need requires different approaches than are required for serving the corporate user. If no increase of funding is available to meet this new demand for administrative data, the administrative computing organization will come under stress. If too much attention is paid to end user computing, the corporate systems user will complain of the draining away of resources intended for centralized systems. If not enough attention is paid to end user computing, the individual end user will complain of the inability to get to the data.

So, given this background, and given that more and more of us are going to be working in organizations that include both administrative and academic computing, what do we need to do to take maximum advantage of the new organizational relationship.

1. Keep communication channels to administrative units open. Administrative users want to know that we still recognize our responsibility for corporate systems.

2. Cooperate as effectively as possible in the networking arena where the sharing of expense is possible and where users are best served by having a single network connection.

3. Share your concerns with your users. For example, if important things are being left undone because of lack of funding, try to get them to help you make the case for increased budget allocations.

4. Avoid redundant support activities where possible. For example, if the academic computing center will support and train users in Lotus 123, then don't support a competing product without good reason.

5. Work for consistent funding and charging mechanisms across all information technology resources. Subsidization encourages the use of resources whether or not their use is the most cost effective for a particular application. A full cost charge back funding mechanism may work as a disincentive for users to make use of central computing resources. Whatever the funding strategy is, it should not serve to disadvantage administrative computing.

6. Take advantage of the partnering that often occurs between information technology vendors and academically oriented computing organizations. In our case, this partnering has enabled us to dramatically increase our mainframe processing power at low cost and to acquire and extensive fiber network. These kinds of partnerships are generally more difficult for administrative units to arrange. This can be one of the biggest pay-offs from a combined operation.

7. Encourage CAUSE, even if it merges with EDUCOM, to preserve some kind of focus on administrative computing so that we can share our concerns and our achievements at a National level.

Conclusion

In summary, there does seem to be a trend toward merging administrative and academic computing departments within a single organization reporting to the academic side of the the house. The argument for this is that these are two similar organizations using similar technology. While I agree the technology is similar, I do not see a great deal of commonality in its use except in the networking area. A great deal of care must be taken in these combined organizations to see that neither academic nor administrative computing is submerged one in the other. The mission of each department must be well understood so that resource sharing enhances rather than undermines objectives.

I know there are some in this room who disagree with what I've said and I'd be happy to hear your thoughts or questions.

Computer-Aided Software Engineering (CASE): Don't Jump on the Bandwagon Unless You Know the Parade Route

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Canada

CASE, the latest technique to hit the information systems community, is the topic of national seminars by leading organizations. These seminars exhort us to be on the leading edge of technology by jumping on the CASE "bandwagon". However, like flow charts, data flow diagrams, structured techniques and fourth-generation languages, CASE will only be of benefit if you know exactly what you need and how to integrate it with your present methodology and organization. After all, what is the use of having an expensive, sophisticated tool to help you design and build a poor system faster?

After describing what CASE tools can and cannot do, this paper outlines the impact CASE will have on your project life-cycle and your organization. In addition, a methodology for successfully implementing a CASE approach in your organization is discussed.

1. In the Beginning

In the beginning, there were business problems which users could not seem to solve with the traditional application of people and machines: general ledger, accounts payable, accounts receivable, payroll, registration, student records, financial aid. So, Man created computers. And all was well.

For a while.

Even before apple entered the business, there was temptation. "There is no problem we cannot solve with punched cards, batch updates and tapes", said some. "Data processing is an Art", said others. "Just give us the time to exercise our creativity and our system will last forever."

Then came the fall. "Why does systems development take so long?" asked the users. "Why does it cost so much?" asked the VP, Finance? "Why can't we get it right the first time? Why can't we eliminate the bugs before implementation?" asked the DP manager. "Why is everything always 90% complete? Why can't you measure productivity?" asked the auditor.

What was DP's answer? "Tools. We don't have the right tools."

Fortunately, the 1970's arrived. A brand new tool was on the horizon: structured techniques. Suddenly, software development was to become a Science. Structured English would become the universal language of both users and programmers. Structure charts would allow anybody to understand what a program did and structured programming would reduce testing and maintenance costs by half.

Then there was Ed Yourdon's magic bubble machine: data flow diagrams. Gane, Sarson, and others soon had rival rectangular bubbles on the market. The word structured was suddenly unleashed on the conference circuit. Other fringe groups even contended that the arrows and labels connecting the bubbles had to be precisely to their specifications. Warnier and Orr quickly got ahead of the bubbles and rectangles and pioneered the famous entity/relationship diagrams. Somebody even had the temerity to suggest that maybe a computer could be used to draw these things. So we all threw away our plastic templates. (Except me, I kept mine for the museum).

At the same time, the materials with which we worked improved dramatically. We discovered data bases, on-line systems, disk storage, virtual operating systems and kilobytes of memory.

What were the business problems to which these new tools and materials were to be applied? General ledger, accounts payable, accounts receivable, payroll, registration, student records, financial aid.

Did structured techniques live up to their promise? Probably not, but today, nobody would ever confess publicly that they write non-structured programs or design batch systems. Did the application backlog shrink? Of course not, we just tackled more complex aspects of the same problems. Were we better able to measure productivity and quality? Perhaps we knew a little more about what not to do; but we certainly did not know what constituted quality software. Another decade began, and in the early 1980's James Martin predicted that if we didn't do something soon every man, woman and child in North America would have to become a programmer in order to keep up with the backlog. Eureka, the automation of programming: 4th generation languages were born, along with end-user computing. We invented wonderful new materials with which to work: electronic mail, voice response, PC workstations, relational databases, query languages, colour touch screens, mass storage devices.

What were the business problems to which these tools and materials were to be applied? General ledger, accounts payable, accounts receivable, payroll, registration, student records, financial aid.

What did the users think? "Why does it take so long; why does it cost so much; why can't you get it right the first time; why can't we measure productivity?"

Here we are about to enter the 1990's. What do information systems professionals answer? (Notice we are not called DP anymore.) Tools. This time, we have the right tool. This one will definitely do the trick: Computer-Aided Software Engineering, the solution for the 1990's!

2. The Bandwagon: Understanding CASE

So, what is this CASE? What tools are really CASE tools? What are the promises of these tools? You can read thirty articles and talk to a dozen vendors and you'll have forty-two different answers to these questions. To help unravel the mystery, let us examine the *components* of CASE, the *concept* of CASE tools and the *promise* of CASE.

Software

This the material which we use to build our "bridge" between the business problem and the solution. Software is more than just programs, it includes the documentation surrounding the programs and the data which the programs use. It is distinguished from hardware primarily by its complexity. It doesn't wear out or break like hardware; it just slowly loses its effectiveness over time.

Engineering

This generally implies Science, not Art; and the building of practical solutions. The concepts of discipline, rigour, standards, correctness and re-useable components come to mind.

When applied to software, engineering would be the **tools**, **procedures** and **methodologies** we use to manipulate the software. However, can we really engineer software solutions? Engineering generally deals with static structures and the application of *the* correct solution to a problem. Are the systems we build static structures? Is there only one correct solution to a business problem? Besides, are systems professionals ready to embrace the discipline which engineering demands?

Computer-Aided

Computers got us into this mess, didn't they? Do you really think they are going to help get us out?

At least, they had the sense not to say "computerized" software engineering; the computer is only going to help us, it is not going to solve the problem by itself. This concept has its roots in computer-aided design (CAD) and computer-aided manufacturing (CAM), which, according to many experts, we could not do without today. So there may be hope after all; if a computer can help build an industrial robot, surely it can help build a payroll system.

CASE Tools

If we were truly to engineer software, we would have to provide a fully integrated set of tools which *enhance or replace human activities* throughout the whole systems development life-cycle. For example, these tools would have to be applied to each of the following processes:

strategic planning
analysis and design
prototyping
data management
documentation production
project management
communication
change control and integration
coding
testing
reverse engineering

Depending on your life-cycle approach, this list may not even be complete. However, if you examine the list carefully, you can see that first, almost any software vendor can claim that any of his products is a CASE tool; and second, no one vendor has a tool for every process.

The CASE Promise

In the famous T.S. Eliott poem, Prufrock measured his life in coffee spoons. We seem to measure our lives in life-cycle pies. (Perhaps there is a franchise opportunity here.) You know the ones I mean; showing how much of the life-cycle is spent on analysis, how much on programming and so forth. If you look at a series of these pies over time you will notice that the proportion of time spent on analysis and design has increased, while the proportion spent on programming has decreased (Figure 1). With CASE tools, you notice an even more dramatic change. Some "experts" suggest that only analysis and design will be necessary and that the tools will produce fully tested code. Others, who are more conservative, suggest that only the coding phase will be totally automated.

These changes in the pies are obvious from this figure; but did you notice that the size of the pie itself does not seem to get smaller! In other words, the elapsed time and resources consumed remain the same. So far, we have only shifted the effort to the earlier phases of the life-cycle, rather than reduced the effort overall. Clearly, one of the benefits you would expect from CASE is still to come.

THE CASE PROMISE

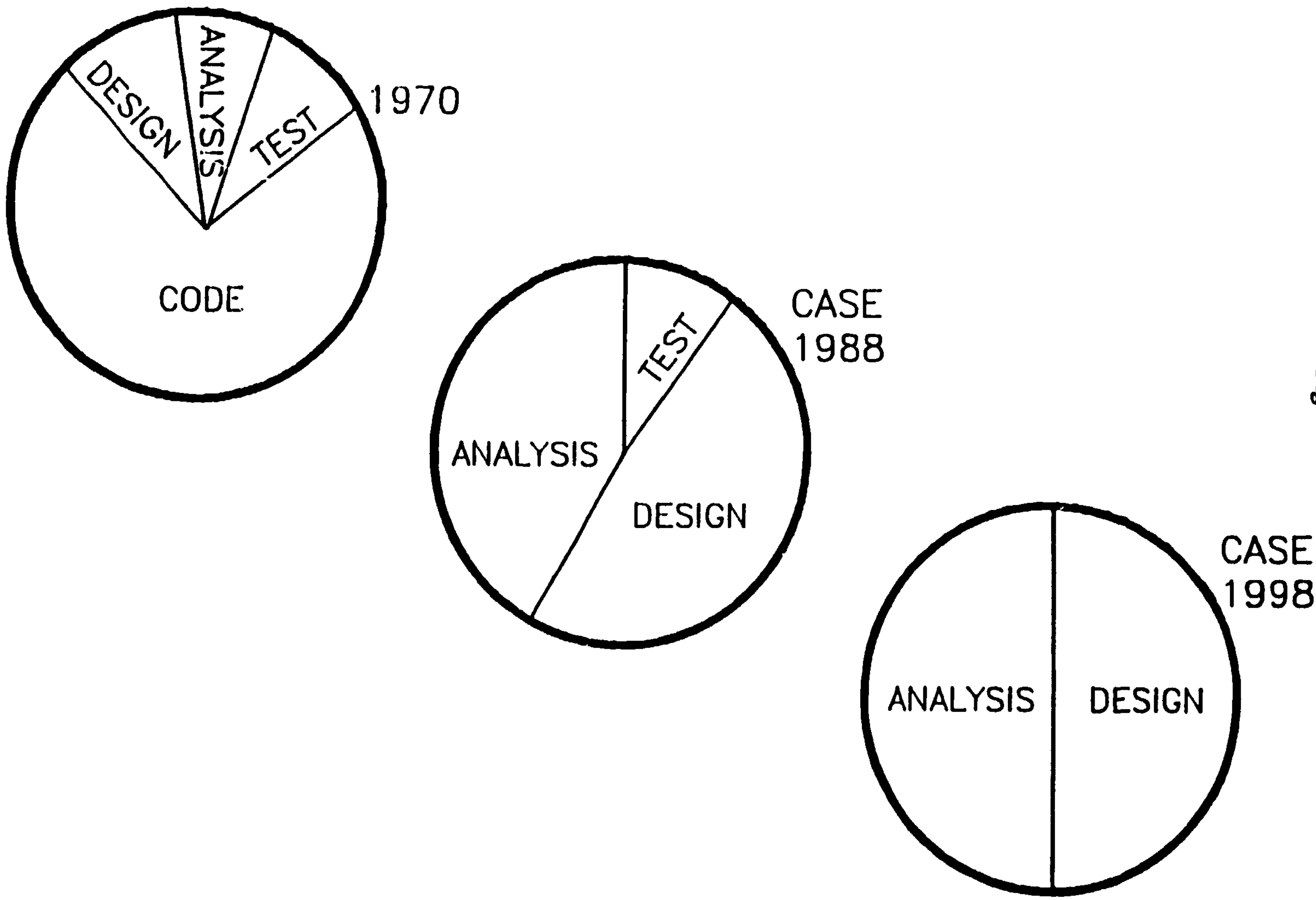

Figure 1

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We know why we have CASE and we know some of what it can and cannot do. Will CASE change your organization? There is no doubt about it. Can you conceive of living without on-line systems to-day? If you can't, you will not be able to conceive of living without CASE to-morrow. James Martin was right. If we are to survive as information systems professionals, we must automate programming. Further, if we are to survive as information systems managers, we must automate the entire systems development life-cycle. Eventually, CASE will do this.

In its current, embryonic state, CASE may not look very promising. Nevertheless, it represents what Dr. Carma McLure describes as a "fundamental change in attitude" and Dr. R.S. Pressman describes as "a multi-disciplinary field that combines management methods and technical methods". Believe it, CASE is here to stay. How are you going to get involved?

3. The Parade Route: Implementing CASE

There have been many articles written and many seminars given on what CASE tools are and how to choose them. Up to know, most of the tools have been produced by specialty software houses, but today the big guns are getting into the business. Digital recently announced a whole "suite" of CASE tools, and Oracle corporation is now touting their version of CASE with the world's best selling relational data base. When IBM finally packages CASE in a big blue box, then we will know it has arrived!

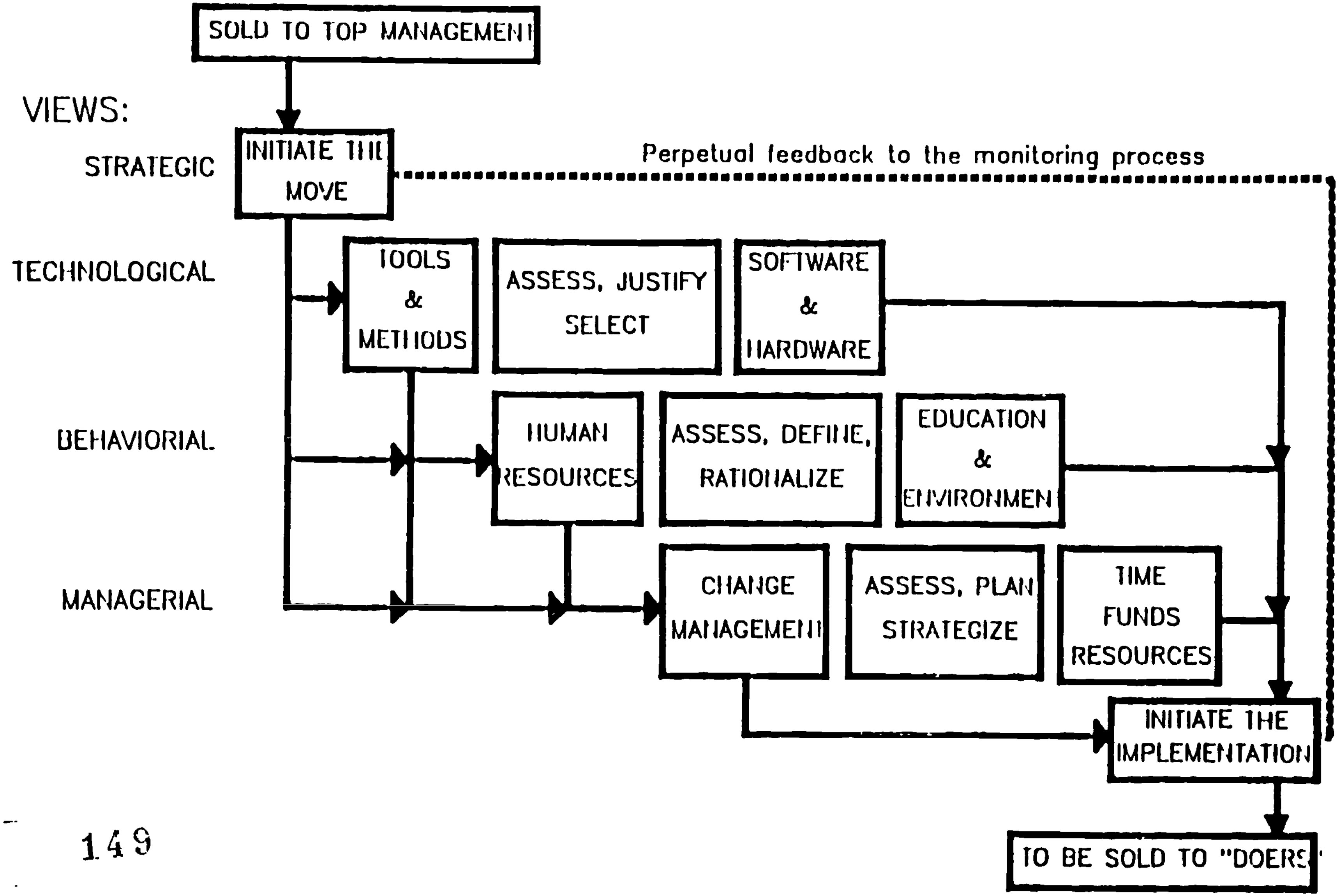
Yet choosing a CASE *tool* is not really the issue. If software engineering means using tools to enhance or replace human activity in all phases of the life-cycle, then an entirely different approach is needed. Figure 2 shows a CASE *framework*, which approaches the implementation of CASE not just from the technological perspective, but also considers strategic, behavioral and managerial aspects. Throughout the process, this approach also suggests a continuous monitoring or evaluation loop, rather than the more common evaluation phase after installation.

What is being proposed here is a complex, integrated process which could completely change your software development life-cycle. The reaction of many managers to such a suggestion is, "I'm too busy with the application backlog to spend time worrying about new approaches". Nevertheless, the first move is up to management. This will not be a one-time technical exercise; it must become an ongoing management challenge, part of the information systems strategic plan. Most of the experts agree that there are certain prerequisites to a CASE approach. If you are unable to manage the three key elements in systems development: people (discipline), process (methodology and tools) and the environment (requirements, scope, business objectives, politics), then CASE will not work as well for you.

From the technological perspective, the goal is to assess, justify and select the appropriate tool set for your organization. This requires at least four separate steps. First, an analysis of the current systems development process is required. Focus on the current state, cost and benefit of the functions, tools, methods and resources you use. Do not spend thousands of dollars automating what isn't worth doing. Second, set the strategic direction. Identify the possible tools and methods which are compatible with where the organization wants to be in the next five to ten years. Third, assess the alternatives and draw up a recommended short list, including a financial assessment. Finally, draw your conclusions. Focus on productivity, profitability and the bottom line. Put together a recommended plan and budget.

CASE IMPLEMENTATION PLANNING FRAMEWORK
GENERAL OUTLINE

Figure 2



From the behavioral perspective, consider first the human resources you will need to operate in a CASE environment. Be careful not to focus just on the use of the tools. Someone will have to manage, maintain, integrate and upgrade them too. A whole new generation of "toolsmiths" will be born. Next, identify the gap between current expertise and that required for CASE. Put together an education plan and a marketing plan. You will have to "sell" many people on the need to change skill sets. Also, beware of underestimating the time, budget and expertise you will need for this selling and education. As Mark Twain said, "A square man cannot be expected to fit into a round hole right away. It takes time to modify his shape". As a manager, you must also realize that while techniques such as newsletters, staff meetings, videos and so forth do transmit useful information, good communication involves listening more than talking.

Finally, from the management perspective there are four focal points in the framework. First, management must take the lead and become knowledgeable about CASE. It must be part of the information systems plan and must be sold to the executives, not just the VP, Information Systems, but the user executives too. This will be no easy task; it is not like a PC and a spreadsheet, from which a user can see immediate benefit. Second, management must fire the starting gun, indicating their commitment to the concept and the process. Third, throughout the process, management must monitor and evaluate, and be willing to change plans and direction as needed. As indicated earlier, this is not a static, one-time exercise. Change management is required. Finally, management must initiate the implementation. Plan big, but implement small!

4. CASE in the 1990's

CASE is clearly growing in the right direction. Already the experts are talking about second generation CASE products. There will be many advances in both the functionality and the technology of CASE. Some of the more interesting aspects to look forward to are the following.

Dictionary Standards

The National Bureau of Standards is working on CASE dictionary standards. If these are implemented, we should see better integration of tools across micros and mainframes, better integration of CASE tools and 4GL tools and the ability to "mix and match" tools from different vendors. Perhaps this will lead to the "seamless" software environment some people are hoping for. Ultimately, this should increase competition and lower prices.

Artificial Intelligence

Ultimately, the dictionary or repository should store an organization's knowledge of the physical environment, allowing automated generation of physical data bases, or risk analysis based on processor capacity or response time. AI could also apply this knowledge from past projects to the project planning phase, or to automate capacity planning.

Automated Testing Before Coding

Some CASE products now boast program testing capabilities; however, the greatest benefits will be gained from automated testing at the design stage, using the business model and data flows. In this way, testing becomes independent of the implementation language.

5. Conclusion

Is it time for you to jump on the CASE bandwagon? Is your organization ready for CASE? Will your systems development staff embrace CASE with open arms?

Unfortunately, all I can leave you with is questions. The next move is up to you.

CASE: Environment, Experiences, Expectations

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Many computing organizations are adopting automated aids to systems development. Among the most promising of these aids in terms of their potential to revolutionize traditional approaches to development are the fully integrated Computer Aided Software Engineering (CASE) tools. The use of these tools can imply much more than simply automating an existing approach to systems development. It requires an approach which is more rigorous, structured and disciplined than that in place in many organizations.

Over the past year, the University of Illinois has acquired and begun using a CASE product. The CASE tool selected, Texas Instruments' Information Engineering Facility, is based upon James Martin's Information Engineering (IE) methodology. Both the methodology and the use of an automated design aid were changes to the application system development life cycle at the University. The IE and CASE environment, the organizational approach to integrating this environment, and experiences resulting from this are discussed. Also, issues relating to expanding the use of this development methodology beyond the start-up group are explored.

INTRODUCTION

The University of Illinois is a two campus institution, with central support for administrative computing. Historically, application systems were developed to meet the needs of a particular customer office. In some cases this led to a proliferation of systems performing the same or similar functions, as well as independent systems which were not interrelated. Although the basic systems are operationally sound, few of these systems provide good management information views. Also, the proliferation of systems, as well as their single purpose focus, requires large maintenance and enhancement efforts against these systems.

To improve the effectiveness of administrative systems at the University of Illinois, three major issues must be addressed. First, administrative systems must be designed to meet the management information needs of the University. Operational systems, while necessary to the functioning of the University, are not sufficient to support the needs of management. This requires an integrated information architecture which allows University information to be viewed as a unified whole, rather than being segregated into administrative and operational systems.

Second, systems must be designed to allow quick response to changes in the University's information needs. This requires a methodology that supports flexibility.

Third, the productivity of the existing systems development staff must be improved. There are a number of aspects to this improvement. The systems developed by the staff must meet the needs of the user community to avoid costly redesign. The development of systems must be accomplished with fewer effort hours. The time span of development projects must be reduced to improve responsiveness to the user community. Finally, the systems developed must require reduced maintenance effort to accomplish inevitable modifications over time.

INFORMATION ENGINEERING METHODOLOGY

METHODOLOGY COMPONENTS

Systems development with the Information Engineering (IE) methodology has seven basic components.

The information strategy planning (ISP) phase supports the definition of the information architecture for a business. The architecture is specified at a general level which describes the information needs for mission critical systems. In addition, ISP provides aids for grouping business functions into logical business areas for development purposes.

The business area analysis component supports the design of a detailed information architecture for a particular business area. This stage of the design details the basic functions and information of one or more application areas, independent of a specific implementation. This results in a design which will be relatively stable over time, since it is independent of current organizational practices. This portion of the analysis provides the building blocks for the later stages.

The business system design component supports the definition of an application system. At this stage, the functions identified in the business area analysis are grouped together to form procedures which will be implemented. Screen design, flow among screens, error processing, etc. are specified at this stage. As specific procedures are added or modified, the changes can typically be effected at this level of design without modification of the basic business analysis.

The technical design component supports definition of the target computing environment, including hardware characteristics and data base management system. Data base definitions are generated automatically during this stage, based on the data analysis done during the business area analysis phase.

The construction phase supports generation of application program and screen code from the specifics of the business system design phase. The work at this stage is highly automated, requiring very little staff effort.

The transition phase is concerned with the conversion from previous practices to the new application environment.

The production phase is the final stage of information engineering in which a system is installed in a production en 'ronment.

METHODOLOGY CHARACTERISTICS

Information Engineering is a data-centered methodology. It begins with an information model of an organization which drives all later design phases. The information model is based on a normalized representation of the organization's data, rather than a design based on application procedures or a particular data base management system technology. Data descriptions are stored centrally in an integrated, non-redundant data repository.

Engineering-like methods are used throughout the design process. The design specification process is fully automated, using the central data repository to integrate the stages of design. Design constraints are rigorously enforced in the automated specification process.

Design components are modular and reusable. Common data types are used across the entire business. Common process modules describe the activities performed on the data at the lowest level which leaves the organization's data in a consistent state. All components are maintained in a central repository for use throughout the organization's application systems. Since components of each design stage conform to the same level and type within the information architecture, they are easily used by all components of the subsequent levels.

Information Engineering depends on application of its methodology on an organization wide basis. This is especially true for the strategic s: as which form the core of an organization's activities. The methodology requires a high degree of coordination across the entire organization, and a high level of commitment at all levels of the organization.

METHODOLOGY ADVANTAGES

The primary advantage of the information engineering methodology is the establishment of an architecture for application systems. This architecture includes both the information required by the business and the processes that operate on that information. Each system builds upon this architecture, rather than existing as a separate application. This provides a true "data base" environment in terms of eliminating redundancy of data, and supporting a consistent view of information across the organization. The reusability of design, through building upon a set of application components, over time results in the ability to develop additional application functions more quickly as the base of defined information and functions expands. IE also provides organization-wide system integration, since each application uses the same information base.

With the IE methodology, the information architecture is independent of the application designs. As the business organization and procedures change, business applications can be modified without affecting the underlying information architecture and business functional specifications. This provides a flexibility and ease of maintenance not found with traditional application systems.

A result of the concept of a single central information architecture is that the architecture evolves, both as application systems continue to be developed and as the business organization changes. These incremental changes may result in modifications to existing applications, but do not lead to complete redesign.

Information engineering methodology is based on the concept that each business has a core set of information and associated functions which are strategic, that is critical, to the success of the business. It facilitates the development of an information architecture centered around the strategic information upon which management decisions are based.

METHODOLOGY IMPACT

The IE methodology changes the components of the system development life cycle significantly. At the beginning of the life cycle, data analysis is done as a formal design step. This analysis is not application specific, as is a data base design phase.

Process and procedure design replace program design. Again, process design is a more general approach. This is not limited to the application at hand, and, thus, is more extensible to additional application areas that may be developed later. Procedure design more closely replaces program design, since this effort results in the specification of particular screens and programs. Also, a formal definition of the flow among the system components is included at this stage.

Since the data and process design phases are concerned with the basic information architecture and functions required by the organization, the level of involvement of the customer's senior management becomes more significant than with traditional methodologies. The initial analysis stage drives the subsequent application design by providing the key design elements and constraints, increasing the need to complete the analysis stage quickly. Taken together, this makes it essential that techniques along the lines of Joint Requirements Planning (JRP) and Joint Application Design (JAD) be used as a central part of the early design phase. Thus, communication skills associated with JRP and JAD activities become much more important in the project management process.

The traditional data base design stage is replaced by automated data base design and definition. Since the data base design is more or less independent of the information architecture, this stage occurs later in the life cycle and is based largely on the data design rather than the application design. As a result, the data design stages are freed from the considerations of data base design/management constraints and performance tuning.

Significant gains in staff productivity are obtained by automating the routine aspects of system development. However, achieving these benefits depends largely on an organization's ability to deal with associated management issues. A higher degree of customer commitment and involvement at the management level is required in the early design process. A more interactive design environment is required, requiring talented analysts with exceptional communication and organization skills. A more structured environment for managing the organization's information architecture must be developed if organization-wide integration is to be developed.

COMPUTER AIDED SOFTWARE ENGINEERING

CASE CHARACTERISTICS

The Computer Aided Software Engineering (CASE) environment has a number of distinctive aspects, which offer improvements in the systems development process.

CASE tools incorporate graphics oriented design. As a result, these tools are easy to learn. Options are menu driven, typically with mouse selection. This eliminates the need to memorize commands, as well as the requirement to correctly type these commands. Also, the graphic display of design information is self-documenting and easy to understand.

The primary development tools are workstation based. This moves the developer off of the mainframe environment, with its more expensive cycles and potential service outages. Also, it provides better response time for the developer.

The CASE environment supports intelligent enforcement of design constraints and enforces consistency across multiple developers. When working with a CASE tool, the developer is not permitted to specify inconsistencies in the design. This is accomplished through interactive or "on the fly" checking, as well as through comprehensive consistency checking at the completion of each phase of the design. Also, since this checking results in the detection of errors when they occur, the effort required to correct them is much less than if they were discovered at the end of the development cycle.

The stages of the systems development life cycle are integrated in the CASE tool. This interface eliminates the "translation" that occurred in manual systems design, as information was passed from the designer to the analyst to the programmer. Also, it eliminates the redundency introduced at each stage, since the analysis results of each subsequent stage build upon, rather than replace, those of the prior stages.

CASE tools are designed to guide the developer through a structured process. Each step of the development process is well defined, with specific deliverables resulting from each stage.

CASE tools automate routine development activities. CASE tools automatically generate application program code, data base definition statements, and screen definitions. The functions automated are some of the most resource intensive activities. This automation of the routine or mechanical aspects of systems development frees developer time for design activities. Also, it ensures that the generated application accurately reflects the analysis as recorded in the CASE tool.

Finally, CASE tools are rigorous and specific. The developer is required to provide complete and detailed information. Items such as the interrelationships of data fields, the sequence of processes, etc., must be fully specified. In doing this, the developer is required to fully understand and record all aspects of the system. Also, this approach to analysis results in small, detailed specifications at each phase of the analysis. The resulting product is a set of small, concise, easy to understand modules.

CASE ADVANTAGES

In addition to the advantages which result from the individual components of a CASE tool, there are overall advantages which arise from the CASE environment.

CASE tools have a positive effect on the timing and staffing of the systems development life cycle. In the typical life cycle, the longest span of time is devoted to coding. With the CASE tools, this phase of development is much faster, due to automated generation of code. Also, the staffing of the curve is significantly affected. In the traditional life cycle, staffing is low at the start and gradually increases with a peak staffing at coding. With the CASE tools, staffing starts out at a higher initial level, remains relatively constant through analysis, with no increase, and potentially a decrease, at the "coding" stage.

The nature of the testing phase is modified since the developer is no longer testing for coding errors. Instead, logic and design errors are uncovered. Also, the incidence of these errors is reduced due to enforced consistency. Revisions are made in terms of the design, with subsequent code regeneration, rather than making revisions to the code.

At the end of development in the CASE environment, the design must accurately reflect the operational system, since the design is the source for the generation of the system. As a result, documentation which truly reflects the completed application results from the process.

As a CASE developed system moves into the maintenance portion of the life cycle, the advantage of the self-documenting nature of the CASE tools becomes apparent. Since the system design is the source for the application, it is never out of sync with the application. This means that the analysis effort is available as a maintenance aid. Also, since changes are made to the analysis, rather than to the code, the skills needed for development and maintenance are similar.

EXPERIENCES

INFORMATION ENGINEERING FACILITY

The particular CASE tool installed at the University of Illinois is the Information Engineering Facility (IEF) developed by Texas Instruments. This particular CASE tool provides a fully integrated environment. As installed at the University, the analysis and design tools are workstation based, running on IBM PS/2's; the central encyclopedia is mainframe based in DB2; and the applications generated are COBOL II, running in a CICS and DB2 environment. The stated direction for the IEF product is to produce portable, SAA compatible systems.

The IEF currently supports the development of on-line applications only. Also, there is little support built into the tool for the transition and production phases. The primary focus of the IEF is the first five components of the IE methodology.

ORGANIZATION

When the IEF was introduced at the University, Administrative Information Systems and Services (AISS) made an organizational commitment to the CASE environment. Staff were assigned full-time to work in the CASE environment. Significant funding was devoted not only to the purchase of the IEF, but to provide equipment and staff training. Time was committed to allow for a learning curve and adaptation to the new environment. This approach was significantly different than that taken with the introduction of various software packages in the the past, in terms of a management commitment. This commitment is vital to success in the introduction of a CASE environment.

AISS carefully selected staff to assign to the CASE team based on expectations of their success with it, rather than on current availability. The initial team was composed of one manager, three senior level analysts, and one inexperienced analyst. The emphasis on senior level analysis skills was due to the fact that the CASE environment provides an analyst workbench. It is not a programming environment. One inexperienced team member was chosen to determine how easily a new analyst could develop skills working in this environment. Organizationally, the group was placed in a special projects area, under the direct supervision of that area's manager, who also functioned as a team member. Placement in this area insulated the group from ongoing operational concerns of existing systems.

In evaluating the team selection, after about one year of work, it is clear that analysis skills are the key issue. Although the CASE environment enforces consistency in design, there is nothing in the tool which can prevent the developer from simply misunderstanding the needs of the customers. Unfortunately, the inexperienced team member left the University shortly after training had begun. At that point, an additional senior staff member was added to the team as a replacement, since it was felt that a senior analyst would be better able to "catch up". Consequently, the effect of the CASE environment on developing analysis skills has not been evaluated.

PILOT PROJECTS

The initial pilot project for the CASE team was the redevelopment of a work request and task tracking system used internally by AISS. This project was chosen because the existing system was inadequate, the scope of the project was limited, the risk associated with the project was minimal, it was primarily an on-line application, and there was no required deadline. The resulting system, which is in the conversion stage, consists of 15 DB2 tables and 71 CICS programs.

In reviewing this project, the major drawback was the size of the system. This error in size occurred because, although the application being replaced was small, in doing a thorough analysis it became clear that the business requirements were far more complex than had been supported previously. This points up the strength of the environment as an analysis aid in supporting a complete understanding of the application requirements. However, implementation of a smaller application would have more quickly demonstrated successful results.

A second pilot project, which involves a customer application is also under way. This project involves the development of a personnel system to support the civil service hiring procedures of the University at both campuses. This project is in the business system design phase.

In working with customer staff, the major difficulty encountered involved communication using the standard products of the IEF (i.e. reports, diagrams, etc.). Many of the diagrams produced, particularly for data design, were foreign and confusing to the customer. It became clear that communication with the customer needed to focus more closely upon the processes and functions to be supported, rather than on the underlying information architecture. Also, there was a temptation by the CASE group to describe their work in the terminology of the IE methodology. This change in language added to customer confusion. In introducing a CASE environment, a change in the language used to communicate with customers must be avoided.

EXPECTATIONS

The choice of strategic application areas will be a major issue in the overall success of CASE. By developing an architecture for primary, strategic systems, the University will be building the framework for its information needs and for the development of applications. Some of the major gains to be realized from the CASE environment come after this foundation is created. This allows additional applications to be quickly developed, since they build upon these basic components, which results in increasing gains in efficiency. Also, the resulting information architecture should meet the central information needs of University management.

AISS must carefully manage the information architecture to ensure that a common foundation is developed, rather than a "crazy quilt" of individual applications. Without central control and coordination, the CASE environment becomes little more than a faster programming language. With central management, the development of each application builds upon those previously designed, again resulting in efficiency improvements. Also, this reduces maintenance requirements by eliminating duplicates, which must be separately maintained and coordinated.

In the CASE environment, the central encyclopedia serves as the corporate repository for applications. The management of this resource is critical to ensure an accurate reflection of the architecture and applications being developed. Since the central encyclopedia is the source for applications, damage to it can interfere with existing CASE-developed applications, as well as with future development.

As the CASE developed architecture grows, training and staffing for CASE development will be an ongoing concern. At this point, the learning curve for an experienced analyst appears to be about six months, primarily due to differences in methodology. Given the length of the learning curve, assignment of dedicated staff is critical.

There are a number of staff morale issues surrounding the introduction of the CASE environment. Some staff view the CASE environment as threatening. For those who have a solid expertise in traditional development and technology, there is a fear of the unknown. Also, staff assigned to the ongoing maintenance of older systems may resent those assigned to "new development" in the CASE environment. Over time, this should become less of an issue as maintenance of CASE developed systems stays within the CASE environment, and as older systems are replaced.

Of particular concern is the role of programming skills in the CASE environment. For those staff assigned primarily to writing computer application code, there is skill obsolescence. Some will view CASE as an opportunity to gain new skills, while others may be unable to adapt. Given that all systems will not be converted immediately, this is a long term issue. However, the retraining of programming staff to perform analyst functions may require a long period of time, so planning cannot be deferred indefinitely.

For all staff working in the CASE environment, communication skills become more critical. As the "back room" functions of development, such as coding and unit testing, become more automated, the customer contact functions will require a greater proportion of staff time. In a sense, this shortening of the development cycle moves the analyst closer to the customer.

CASE also has an impact in terms of customer involvement in development. Since the development cycle is compressed, the customer must be prepared to commit a greater proportion of time during the time frame of the project. This can be a difficult adjustment for customers who are accustomed to having the developer spend weeks preparing documentation resulting from a brief session. Since most customers have ongoing responsibilities aside from the development project it can be difficult for them to devote sufficient time to a CASE development effort.

CONCLUSION

Although there is a temptation to view the CASE environment as the "bleeding edge" of computing at this point in time, the methodology and toolset is available, and success can be achieved now. The single key factor to achieving success is commitment. This includes commitment to a development methodology, management commitment, and staff commitment to success. While the CASE tools will become more complete as time passes, the issues of organization adaptation will not disappear. Staff will require time to grow into the CASE environment. By starting now, an organization can be positioned to grow with the CASE environment.

Telecommunications as the Umbrella for Managing the Linkage and Integration of Resources: A Practitioner's View

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ABSTRACT

This paper summarizes the development of a comprehensive five-year strategic plan for linking and integrating several currently disjointed information resource communication systems using the umbrella of telecommunications. A broad range of programs and services are encompassed in this study, including emphasis on areas of energy management and surveillance and security. Additional areas of focus are voice communications, data communications, video communications, office automation, administrative computing, and instructional computing. The end product of this study is a strategic master plan which presents an infrastructure of telecommunications, computing, information systems, surveillance, security, and energy management. The plan describes in detail the integration of separate aspects of these systems.

INTRODUCTION

This abstracted version of a longer paper succinctly describes how one institution is preparing to meet the demands of the ever-emerging information society. Senior executives of the institution realize that in order to reach virtually every desired university goal and objective, there is a related need to improve the technological base of the campus. Presented here is a summary of a comprehensive five-year strategic plan for such improvements, which involves the full scope of telecommunications programs and services. Some objectives of the strategic plan are to:

* Establish telecommunications as a foundation for information;

* Embrace the philosophy of user-driven and distributed computing;

* Increase decentralization of access to information processing resources;

* Integrate network based applications, such as voice, data, video, energy management, surveillance and security;

* Accommodate new applications such as electronic mail, computer conferencing, bulletin boards, etc.

The plan is designed to assist the senior leadership and the governance structure for telecommunications in understanding and developing plans and strategies for more fully utilizing the complete spectrum of information resource technologies to the benefit of the entire university community. It is flexible and suitable for adoption by other universities or institutions desirous of a workable strategy for linking and integrating computing resources.

STRATEGIC APPROACH TO LINKING AND INTEGRATING RESOURCES

Strategic Thinking

Without a doubt, strategic thinking paved the way for the development of Grambling State University's (GSU) five-year strategic plan for information resources. Administrators recognized that we are rapidly becoming an information society in which changes in our way of doing things are no longer occurring in the usual evolutionary manner, but rather in a revolutionary manner. GSU sought to prepare for the information society by establishing telecommunications as the foundation for computing and communication.

The preliminary foundation building for this task began in 1979 when GSU secured state funding for a "New and Expanded Telephone System" (State Project, 1979). As the title implies, this $850,000 project expanded the

scope of communication services in some areas and made new services available to other areas. At the same time, provisions were made for future growth and expansion although the idea of telecommunications as an umbrella had not yet been envisioned.

However, in 1984, three years after implementing its first five-year plan, GSU recognized the need to establish telecommunications as the foundation for information resources. The university wanted to dismantle the existing system of information resource management which was nothing more than a fragmented collection of public utilities and relics of a 1940's campus communication system. It was at this point that the university set two major goals for itself. These were 1) to plan and organize for effectiveness and 2) to establish telecommunications as the foundation for computing and communication.

By 1986, in the second iteration of the planning cycle, strategic thinking had become even more important. In fact, it was determined to be one of the four major strategies for improving management capabilities at GSU. Strategic thinking resulted in the development and eventual funding of a major grant to implement an enhancement activity referred to as "Strengthening the Linkage and Integration of Computing Resources." This developmental program has evolved into a fairly extensive telecommunications and information processing environment.

In addition, GSU has, over the last five years, implemented a plan to improve the computer support for administrative operations by expanding its on-line, interactive capabilities and by developing an hierarchy of information systems (HIS/MIS). The impending installation and development of a "VAX Family" will significantly decrease the practical limitations on the number of simultaneous, on-line administrative users which can be accommodated. The HIS/MIS has enhanced and strengthened GSU's management capabilities by providing the information necessary to support all levels of administrative activities.

During the planning and implementation of these first telecommunications/computing improvements, GSU's executive management was astute enough (thought strategically enough) to recognize even larger needs and, as a result, expanded the scope of its vision. We decided to plan for revolutionary rather than evolutionary improvements in the information resources and management capabilities of the university. Instead of allowing computing and communication resources to remain disjointed, the idea was conceived to totally reorganize computing and communication under the umbrella of telecommunications.

Conceptualization of the Telecommunications Umbrella Within the 7-S Framework

At GSU, we espouse the viewpoint that a strong foundation for excellence can be established by pursuing a number of important strategies. One of these strategies is the adoption of McKinsey's 7-S Framework as a planning paradigm (Lundy & Carter, 1988). The 7-S Framework has the appearance of an atom with seven factors, all beginning with the letter "S" (Peters & Waterman, 1982).

Using the seven elements of this model, we assessed our current computing and communications resources and determined our needs. In other words, the Telecommunications Strategic Plan is a blueprint for improvements in efficiency/effectiveness consisting of an analysis of the 7-S elements: 1) superordinate goals or shared values, 2) strategy, 3) structure, 4) systems, 5) staff, 6) skills, and 7) style. A brief synopsis of the analysis is presented below. (Further explanation of the 7-S Framework is included in a longer version of this paper.)

Superordinate Goals (Shared Values)

GSU's shared values embrace the motto that "GSU is the place where everybody is somebody!" This philosophical statement accentuates the university's commitment to students who have been adversely affected by educational, social, and economic deprivation. The philosophy also extends to the university's treatment of faculty, staff, and other constituents. More importantly, this foundational tenet establishes the sound basis from which we build GSU's institutional culture.

Another shared value which is specifically related to GSU's vision for telecommunications is highlighted in the Statement of Institutional Mission and Philosophy. It states that "GSU strives ...to strengthen its institutional effectiveness and academic programs by developing and implementing new and enhanced informational technologies..." These shared values are the base from which the remaining 6-S's emanate.

Strategy

Linkage and Integration of Information Resources (Computing)

In its preparation for the "Information Society", GSU must adopt carefully chosen long-range strategies and short-range tactical plans to achieve a sufficient degree of information processing intensity to ensure the survival of the institution. An essential strategy in achieving this goal is to link and integrate GSU's computing resources. Furthermore, GSU is convinced that it can achieve its goal by embracing the philosophy of user-driven computing. One of the keys to developing this new environment involves replacing the traditional telephone and computing delivery systems with an integrated voice, data, and video system that facilitates distributed computer applications. GSU is committed to planning for an environment of increased decentralization of access to information-processing resources which require a shift in emphasis from centralized facilities to the use of terminals and microcomputers on every desk top. Obviously, the implementation of decentralized access and distributed-computer applications will require a basic definition of computer literacy for students, faculty, and staff. Ultimately, GSU hopes to create an extensive environment of academic and administrative computing supported by a networked configuration of mainframe computers, minicomputers and microcomputer laboratories. These components would support enhancements which incorporate the new information technologies.

The university has been engaged in a program to strengthen its management capabilities and to enhance services to Academics, Student Services, Administration and various other clientele. Over the last four years--in order to acquire an infrastructure of computing and telecommunications equipment--GSU has expended approximately 5.2 million dollars.

Another fundamental strategy in achieving the linkage and integration of computing resources has been the completion of GSU's comprehensive strategic plan for information resources. State funds were secured to engage a nationally known computing and telecommunications firm to assist the university in this effort. This plan is extensive and includes many aspects of the current planning process. A discussion of these planning components is presented in the section titled "Developmental Plan for Telecommunications." Specific strategies, however, are described below.

The Vice President for Administration and Strategic Planning has the primary responsibility for the derivation and completion of the plan. Additionally, he assists the Director of Computing and Telecommunications in developing and implementing the activities associated with the plan.

Many of the projects recommended in this plan to fulfill the future needs of GSU and its sub-units mandate incremental funding beyond the university's current "budget base." Therefore, critically needed Title III funds totalling 1.5 million dollars were provided to support the implementation of the following strategies:

1) Implementing an integrated voice, data, and video Local Area Network (LAN);

2) Installing an outside cable plant using fiber optics technology;

3) Acquiring and linking (clustering) a VAX 8350 computer with other VAX computers ("Vax Family");

4) Establishing a Computer Information Center;

5) Upgrading existing computing hardware and software; and,

6) Developing and implementing a training program in computer literacy for academic users.

To ensure that all of these strategies are successfully implemented, the university's Network Task Force will monitor the progress on levels of achievement. As structured, the Task Force has broad representation from each major functional area of the university. The Senior Director of Computing and Telecommunications is chairman of the Network Task Force.

Since GSU's vision of the future is a totally integrated environment characterized as network-centered, workstation-based, server-enhanced, and software-integrated, two more equally important strategies had to be pursued:

1) Encouraging South Central Bell to replace its obsolete Step-Mechanical Switch in the Town of Grambling to ensure interface capability with GSU's enhanced technological base; and

2) Convinci g the Louisiana State Office of Telecommunications Management (OTM) to serve on GSU's Network Task Force.

South Central Bell finally upgraded the Telephone Exchange Building and the sw:tch for the Town of Grambling in 1986. However, South Central Bell's positive response occurred only after numerous admonitions from GSU's executive management and OTM, one of the university's state governance structures.

Related to the s^cond strategy, GSU had to pursue any expedient and legitimate course of action which could lead to the allocation of additional resources to the institution's coffers for information resources. Thus, OTM officials were invited and strongly encouraged to serve on the university's Network Task Force. In fact, the Assistant Director for Administration and the Customer Services Officer of OTM are permanent members of the Network Task Force. We believed that their presence on the Task Force would place them in a better position to understand GSU's needs and priorities, and that they would subsequently, provide the support the university needed to secure additional funds for development of the telecommunications master plan. This relationship also served to improve the level of commmunication and the rapport between GSU and this important state agency.

Structure

As might be expected, a change in direction (superordinate goals) and new stracegic approaches (strategy) quite naturally lead to structural alterations. GSU's vision for informat on resources demanded that the old fragmented computing and communications organizational structures be changed. At one time computing resources were under the control of the computing center. However, the technical aspects of telecommunications were housed in the physical plant. Switchboard operations reported to Auxiliary Management and communications reported to the Vice President for Administration.

Under new vice presidential leadership (1986) it was decided that there should be a merger of these functions. The new organization integrates the disjointed aspects of information resources under the single umbrella of Telecommunications and Computing. This merger was viewed as the most effective and cost efficient way to achieve the major planning strategy of establishing "telecommunications as the foundation for computing and communication at GSU" (Lundy, 1986). The rationale for this strategy lies in the recognition that increasing decentralization of access to computing resources means that campus computing centers must become more closely integrated with campus telecommunications systems.

Developmental/Support Committees

Also related to structure is the establishment of telecommunications developmental/support committees. These committees were set up to perform strategic analyses of relevant issues and communicate the results to executive management providing the information needed to make strategic decisions. The committee structure evolved from an original 6-member team charged with developing a plan for improving the telephone system to a 28-member group charged with the responsibility of 1) developing policies and procedures for information systems, 2) establishing priorities for the development of new and existing components and devices in the new networked environment, and 3) ensuring the linkage and integration of information resources. (A more detailed discussion of the evolution of developmental/support committees is presented in a longer version of this paper.)

Policy and Procedures

Along with structural changes also come policy and procedural considerations. One major policy issue emanating from GSU's Telecommunications Strategic Plan has resulted in revisions to State policy. OTM entered into an agreement with GSU which allowed the installation of a telephone node in every new building on campus. Also, GSU was able to convince State Facility Planning and Control to include station wiring as a mandatory aspect of the cost of new construction.

Our vision for telecommunications also led to GSU becoming its own utility company. This, of course, resulted in other policy issues. For instance, policy had to be developed related to our state of self-sustainment; policy had to be developed to cover the establishment of another auxiliary enterprise (i.e., a new budget unit); policy was needed to govern pricing procedures and to institute cost recovery systems for selected telecommunications programs and services.

Another major policy issue revolved around the acquisition and use of equipment at GSU. Policies and procedures were established to implement a local area network based on use of the Ethernet TCP/IP protocol. As such, the university could maximize use of existing resources and eliminate the prerogative to acquire any device not usable in the ultimate configuration. Consequently, all instructional and administrative systems host computers at GSU will support an Ethernet composite interface. Other policy issue continue to emerge and resolutions are forthcoming.

Systems

History of the Telephone System

Prior to 1984, GSU's voice communication was supplied by an antiquated cable plant and switch which were installed in the 1940's. This outdated technology greatly limited the university's ability to provide basic telephone services.

Shortly after assuming leadership of GSU in 1977, the new administration formulated strategies to replace the obsolete telephone system. A telephone system committee was appointed to study and recommend preliminary plans for a new and expanded telephone system.

The proposed plan of the committee (submitted on October 29, 1979) was accepted by GSU's executive management and converted into a capital outlay project entitled "Improvement and Expansion of Telephone System." This two-phase capital outlay project called for a complete overhaul of the telephone system.

Funds for the project were provided via Legislative appropriations. The appropriations also paid for a Cable Plant and a Telephone Exchange Building which were erected during the time span of 1981-1983.

Recent and current enhancements to the telecommunications system have been made possible by a supplemental appropriation of $800,000 to a project entitled "Energy Management, Telecommunications, Surveillance and Security Systems." With these funds, two recent additions were made to the outside cable plant. Also, a current enhancement involves installing a fifth VLCBX node to temporarily resolve a capacity problem.

It is important to mention that the RC M VLCBX was purchased from Centel--the only au:horized distributor of ROLM products in Louisiana. As an initial strategy, executive management decided to consummate a contract with Centel to maintain and to operate the switch and the cable plant for fees totaling $150,000 per year. This decision was made because GSU did not have enough expertise in telecommunications when both phases of the project were completed in the Fall of 1984. A discussion of GSU's strategy for acquiring permanent technical expertise appears in the section titled "Skills/Staff".

Current Voice Communication System

Voice communications services are provided to GSU faculty and staff as well as to students who reside in campus dormitories. There are about 2,500 stations in operation at this time, with station sharing i ffect in some instances.

GSU installed a four-node ROLM VLCBX (very large computerized branch exchange) PBX system on campus. Technical and procurement support were provided by the Louisiana State Office of Telecommunications Management. The VLCBX nodes are co-located in the PBX Telephone Exchange Building. This centralized distribution of telecommunications services corresponds to the outside telephone cable plant also centrally distributed from the Telephone Exchange Building.

Since the initial PBX installation in 1984, there have been only a few additions and upgrades. These additions and upgrades to the PBX include the following:

* Additional extension motherboards and associated eight channel extension cords to increase the extension equipped-for capacity to approximately the maximum wired-for capacity of the system.

* Recent system applications upgrades which include: forced authorization codes (FAC) and call detail recording (CDR)

* The addition of various manufacturer specified corrective software patches for the system.

A new outside telephone cable plant was installed at the same time as the ROLM PBX. This consisted of 24 American Wire Gauge (AWG) direct buried Alpeth feeder cables to each building. New outside telephone cable termination pedestals were also added. In addi - new main distribution frame (MDF) with 66 type connector blocks, correspon...g lightning protection modules, and new intermediate distribution frames (IDFs) with corresponding interframe (MDF to IDF) cabling were installed in each building.

Since the initial GSU campuswide cable plant was installed, two additions were made to the outside cable plant. These included the implementation of a telecommunications manhole, multi-duct 4" PVC conduits, and 1200 pairs of 24 AWG Alpeth cable.

Telephone System Upgrade

GSU's existing PBX is operating at 97 percent of its extension capacity. Therefore, the university is currently unable to provide additional lines to meet the ongoing day-to-day requests for service.

To temporarily resolve this capacity problem, a fifth VLCBX node for GSU has been ordered. The new node will increase the telephone extension capacity as well as the trunking capacity.

ROLMphone telephone stations (voice only and integrated voice and data synchronous/asynchronous) will replace the currently used ROLM electronic telephone sets (ETS) and will also introduce integrated voice and data switching through the PBX. Terminal devices will primarily access the academic host computer system (i.e., VAX 11/780). A few of the terminal devices will support administrative users accessing the administrative host (i.e., DEC PDP 11/70, PDP 11/84).

The reconfiguration required for the addition of the new node will upgrade the VLCBX system software to Release 9004. ROLM route optimization software will also be installed in the upgrade providing the VLCBX with the intelligence to select the most cost effective routing of calls placed over GSU's trunking facilities.

Future System Needs/Requirements

Even though GSU has installed a PBX system, the existing operation does not reflect a corresponding expansion of function, operation, or management in terms of scope and depth. This is partially due to the controls at the State level.

Fourteen major needs/requirements evolved from developing the telecommunications plan. (Each is more fully described in the full length

version of this paper.) Planning, implementing, and operating the utility now and as it will evolve over the next several years will require managerial as well as operational changes in order to move toward full functional utility.

Skills/Staff

It is a well known fact that IBM acquired ROLM to provide the technological capability it greatly desired to have in voice communication. On a much smaller scale, GSU pursued a similar strategy.

After GSU's one-year maintenance and operations contract with Centel had expired, executive management proceeded to implement the strategic decision to acquire permanent expertise in telecommunications by hiring Centel's certified ROLM technician. A successful strategy included an offer to double the technician's existing salary. Without hesitation, the former Centel technician decided to "secure his future" with the place "Where Everybody is Somebody."

The decision to hire Centel's telecommunications technician was a major step in consumating executive management's plans to merge the telecommunications and computing functions and to create GSU's own Telecommunications Utility. Executive management gave two fundamental reasons for merging voice and data communications: 1) the well-documented trends in merging or converging technologies (voice, data, and video); and 2) the well-documented trends in commonality of transmission media (broadband, fiber optics, twisted pairs, etc.).

Moreover, executive management understood how improvements in technology have allowed voice communication to move from analog processing to digital processing. Voice signals could be digitized and processed in the same manner as data. Therefore, executive management was convinced that the university's Telecommunications Utility must be staffed by "technocrats" who possessed excellent skills in computing. Thus, the Director of the Computer Center became Senior Director of Telecommunications and Computing. Two additional "technocrats" with computing skills were hired primarily for the telecommunications function. They received on-the-job training in the fundamental functions of a Telecommunications Utility (installing telephones, pulling lines, etc.).

Executive management also understood that for the university environment to function smoothly and cooperatively, there had to be an appropriate mix of "technocrats and bureaucrats." Therefore, in recognition of this principle, a Telecommunications Liaison Officer was appointed. This bureaucrat had to have good public and human relations skills to be able to perform a myriad of duties.

Style

GSU's style of management is best explained via an excerpt from the University's Statement of Institutional Mission and Philosophy.

"GSU strives... to create an environment where participatory management is an accepted organizational norm..."

We have adopted a decentralized, egalitarian approach to management that is participatory and objective oriented, i.e., management by objectives.

Developmental Plan for Telecommunications

With the above 7-S analysis of our needs and desires in place, we were ready to put together a strategic master plan for telecommunications. Every conceivable aspect had been considered. However, in order to check and verify, to add further credibility, and to reduce the probability of state-level bureaucratic resistance, external consultants were contracted to write the final version of the plan.

The consultants, Systems and Computer Technology Corporation (SCT), followed the lead already paved by the on-going strategic planning process at GSU and our assessment of the plan's scope. In addition, the consultants conducted an extensive review of existing internal documents along with interviews with a cross-section of university personnel to establish a base of information from which to produce the final plan. Additional interviews were conducted with representatives of various state offices and information relating to how other institutions are solving the network requirement that results from the integration of individual application area needs was collected and analyzed. Combined with the specific needs of GSU, this aggregated information was used to develop the strategic plan.

The consultants analyzed four basic areas in determining the ideal telecommunications needs for GSU. These included: 1) a review of relevant trends affecting the nature and scope of information resources in higher education; 2) the completion of an environmental scan (assessment) of the university's internal and external environments; 3) a user needs assessment; and 4) an inventory of current and future computing system needs. A synthesis of information from these four sources established the foundation for an assessment of the integrated user needs as well as the integrated functional needs. The needs, of course, determined the network design approaches.

Other developmental aspects of the plan included: 1) the articulation of a functional mission statement, 2) the relationship between university goals and plan goals, 3) administrative goals, 4) operational goals, and 5) planning assumptions and strategic guidelines. These aspects of the plan are described in a longer version of this paper.

PROJECT SCHEDULE AND BUDGET INFORMATION

Exhibit 1 shows the anticipated sequence for implementing the technical projects described throughout the Telecommunications Strategic Plan. The sequence is based upon a year-by-year progression toward arriving at the

desired campuswide improvements to the existing and installation of the new and integrated communications utility. It is not intended that one project be completed before another is begun, but rather that several projects be in progress at the same time depending upon resources and capable project management.

[Insert Exhibit 1 here]

With regard to budgeting parameters, it is estimated that all projects may be completed for approximately $750,000. This figure does not include total expansion of the campuswide LAN. It is estimated that each workstation added to the LAN will cost approximately $650 per hookup, not including the cost of the actual workstation itself. Individual cost estimates are included within the project plans where applicable.

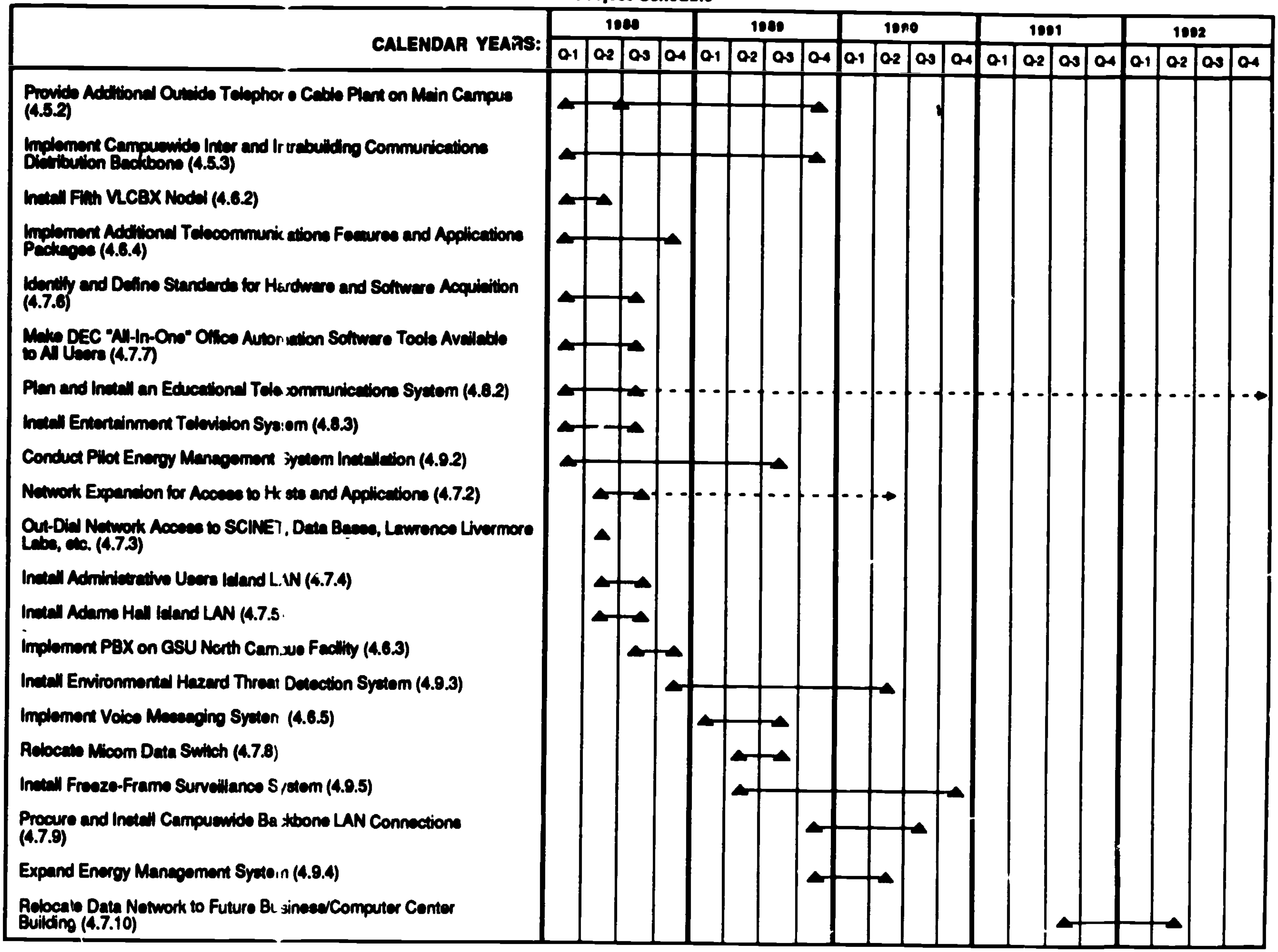
SUMMARY AND CONCLUSIONS

The purpose of this Plan is to serve as a roadmap for the development and implementation of GSU's telecommunications network for managing the linkage and integration of resources. The **"umbrella"** theme departs from the traditional computing dominance and terminology that is being phased out at some of the more progressive higher education institutions. It will take some rethinking and relearning on the part of most campus personnel to become acclimated to the newer focus. There are additional campus support services and functions that may be considered for inclusion under this umbrella over time -- and, in fact, the more technologically sophisticated the GSU environment becomes, the wider the range of coverage of the umbrella.

While the overall perspective of the telecommunications framework or umbrella is a theme, an underlying but significant emphasis within the Telecommunications Strategic Plan is to provide smaller-scale, shorter-term, and flexible project plans. Implementing these plans will incrementally move the campus into the desired telecommunications environment at a measured pace and within reasonable spending parameters, while at the same time propelling the institution along its path toward "Creating and Achieving Excellence in All Programs and Activities."

EXHIBIT 1

Project Schedule



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PLANT OPERATIONS IN TRANSITION: A CASE STUDY IN THE MANAGEMENT OF CHANGE

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To protect its almost $5 billion investment in its 19-campus physical system, the California State University embarked upon a major program to replace its fragmented, manual plant operations processes with a highly integrated on-line Maintenance Management System (MMS). A review of those forces behind the effort to automate a largely neglected, benign organization such as plant operations is then followed by an analysis of the massive changes in plant operations. Finally, the improvements - both direct and secondary - are described in terms that might apply to any successful effort which imposes a complex, computer-based system on an environment of reluctant participants.

THE ENVIRONMENT

The California State University is a system of higher education which satisfies that large segment of students between the community colleges and the more selective research-oriented universities. Supporting an enrollment of over 350,000 students, the citizens of California have entrusted the California State University (CSU) with an endowment of more than six billion dollars invested in over 1,000 buildings and related equipment to support the educational mission. Like much of the infrastructure in the United States, these facilities are deteriorating at an increasing rate. Approximately half of the CSU's facilities were built over 30 years ago. The internal support systems in these older buildings are obsolete compared to the high technology now available. Budgetary non-emergency tasks have been deferred again and again. If future generations are to enjoy the benefits of a satisfactory educational environment, this endowment must be better protected and cared for through more aggressive resource management.

The California Legislature recognized the need to protect this investment, and in supplementary language to the 1979/80 State Budget Bill expressed the belief that this protection could best be accomplished through a systemwide policy of preventive maintenance. Since that budget bill was enacted, the CSU has made facilities maintenance a primary goal. A substantial effort on the part of campus and central office administrators has resulted in demonstrable gains throughout the Universities. The Work Control Center concept, computerized preventive maintenance, and a 5-year plan for programmed maintenance have been implemented on every campus. The Maintenance Management System (MMS) is the capstone of that effort.

THE ROLE OF PLANT OPERATIONS

Plant operations is a service organization responsible for the maintenance and repair of the campus, which includes all structures, basic building components, utilities, grounds, roads, and parking lots. In the CSU, maintenance is defined as the work necessary to keep all state-owned facilities in good repair and operating condition. These services include: utility systems (electricity, water, gas, heat, ventilation, air conditioning, plumbing, sewage, and elevators); and maintaining and repairing basic components of buildings and grounds (foundations, walls, roofs, stairs, ceiling, floors, floor coverings, doors, windows, hardware, turf, sidewalks, streets, trees and equipment).

This maintenance definition specifically excludes new construction and alteration of existing facilities, such as, adding decorative treatment to buildings and grounds, attaching items to buildings, extending or modifying utility systems, and repairing, fabricating, modifying or installing new equipment. These functions must be provided as "chargeback" services.

In practice, the responsibilities of plant operation have been carried out by:

- Providing services necessary to keep facilities operational, e.g., repairing and monitoring the heating/cooling, electrical and plumbing systems, and the building components;

- Administering a Preventive/Programmed Maintenance System designed to protect the plant, enhance the learning environment, and extend the useful life of buildings and facilities;

- Providing custodial services and maintaining an acceptable level of cleaning;

- Providing grounds services to maintain turf, trees and flora around roads, paths, buildings and parking lots, and athletic fields;

- Developing and managing energy conservation projects designed to reduce energy consumption;

- Providing services such as key control, motor pool management, project planning, estimating and project design; and

- Providing contract management for capital outlay and special repair projects.

Plant operations is also deeply involved in environmental health and safety efforts, such as asbestos abatement, PCB removal, and carcinogen control.

The new policy divides all of the work done by plant operations into two categories - maintenance and non-maintenance. Maintenance activities can be broadly subdivided into the four specific sub-categories defined below:

- Preventive maintenance is a pattern of periodic, repetitive tasks specified for and applied to discrete parts of buildings, equipment, and systems, scheduled to be performed at intervals of less than one year.

- Programmed maintenance is a plan to refurbish or replace parts of buildings, equipment, and systems as they wear out or in a cycle in excess of one year, e.g., carpets, window coverings, painting, etc.

- Emergency maintenance is the response to a condition or problem whose correction is time critical and urgent.

- Corrective maintenance is usually the repair, adjustment, or replacement of a device or component at a time convenient to the organization.

In general, plant operations had possessed a personality similar to any highly bureaucratic organization. Plant operations:

- Was reactive rather than proactive to needs and processes;
- Undertook little or no planning in establishing directions;
- Recognized long traditions of behavior and procedures;
- Maintained mostly manual records, if at all;
- Consisted of highly discrete functions - purchasing, material control, estimating, planning, etc.;
- Emphasized technical leadership instead of professional management;
- Fostered the informal or underground network in identifying assignments and establishing priorities; and finally,
- Developed unevenly and sporadically from campus to campus.

Plant operations suffered benign neglect. It was treated a' a third class citizen, and its resources were unhesitatingly exploited by ambitious campus presidents who needed to support non-funded activities such as Health and Safety Officers, Affirmative Action Directors, and Athletic Coaches.

FORCES FOR CHANGE

For the past five years within the CSU, plant operations has been undergoing massive change. During this period, there have been a series of developments which, as a major cost center within the CSU, have raised intense interest among the members of the State Legislature as well as those in the control agencies of the executive branch. Several rounds of reductions in new construction budgets, personnel, and operating budgets, as well as the advent of collective bargaining, have given new visibility to the accelerating deterioration of the physical facilities of the CSU. Some significant forces for change have been:

* Emphasis on maintenance and away from construction;
* Introduction of the chargeback policy on many services which the institutions need and have not paid for in the past;
* Aging buildings and other facilities;
* Construction of high-rise buildings;
* Requirements for handicapped access;

* Environmental health and safety requirements, such as: PCB removal, asbestos removal, and control of carcinogens;

* Cuts in the labor force;

* Introduction of new instructional technology,

* Energy management;

* Collective bargaining;

* Introduction of the Work Control Concept;

* The edict to install a preventive/programmed maintenance concept;

* Increased requirement for accountability;

The introduction of the Work Control Concept has required the creation of a Work Order Control Center on each campus. The activation of this structure before the implementation of the automated system had a major impact upon the success of the new computer-based application. The Work Control Center focuses all communications between the campus community and plant operations through a single point. All incoming telephone calls, including emergencies, and scheduled service requests as well as work assignments are channeled through this one central point. Confusion, duplication and inconsistencies can be avoided. At the command of this operation is the Work Control Center Coordinator who gives considerable attention to all the functions within plant operations.

Also prior to any attempt to automate the maintenance activities, pressure was being exerted upon the campus not to redirect funds for construction projects, e.g., moving doors, installing power receptacles, erecting walls, etc. Of course, billing customers for such services received required a new consciousness toward collecting and maintaining accurate, complete records on the labor, materials and overhead assigned to a project. More precise estimating of costs and scheduling of work became a requisite. And, naturally, variance reporting was a by-product of information demanded by the "customer".

Another edict issued by the auditors was the requirement that access to materials, supplies, and equipment found in the warehouse be controlled. Where there were warehouses, entry was largely as needed and there developed a strong suspicion that inventories were vanishing. The order to more closely control inventories included the practice of applying such principles as reorder points, frequency counts, and continuous inventory counting.

The controls suggested by the auditors were labor intensive and produced vast quantities of data. Manual efforts to conform to these new procedures overwhelmed existing plant operations resources, and some of the more determined managers looked to automated computer-based solutions. However, it did not make sense to reinvent the solution 19 times.

VEHICLES FOR CHANGE

A number of managers within the plant operations offices became inspired and enthusiastic about a jointly-developed, systemwide solution to their needs to upgrade their maintenance functions. What further enhanced the opportunity to advance the environment into a sophisticated computer-based solution were other factors which had already arrived at a mature state. These are briefly described below:

* Professionally Developed Turn-key Systems. That there existed a large number of maintenance applications on the market gave creditability to such a solution. Conceived and developed by engineering firms, these systems could be customized to meet unique operating requirements.

* Reduced Costs of Hardware. Most solutions were based on the smaller mini-processors, allowing turn-key systems to be affordable.

* Ease of Operation. The new systems allowed plant operations to install and operate the equipment with a minimum of expert, technical support.

* Fourth Generation Environment. The users could identify their needs and make minor extensions and improvements in information reporting requirements. Users could control their own destiny (or at least believe they could).

* On-line Access to Information. Updating and reporting requirements necessitated a real-time environment. Immediate response to the real world was essential.

* Organization Structure. The Work Center Concept, when adopted, produced a highly structured, well-defined and documented organization. Few changes in the chain of command and interaction among personnel were required to install the system.

Most important. there was a genuine commitment at the corporate level of .dministration. The Vice Chancellor, as well as most campus vice presidents, were behind the project.

PLANNING FOR CHANGE

Already in place was a special committee with broad-based representation from each campus' plant operations organization. Called the Plant Operations Project Group, this committee became the Maintenance Management System (MMS) Steering Committee and status reports were received during its periodic meetings. The Technical Team consisted of a highly articulate member from a campus plant operations; a senior member from among the campuses' data processing directors who was also named the project

eader; and a plant operations specialist from the Chancellor's Office. Subsequently, after award of the bid, the Technical Team was augmented with an individual who was knowledgeable of organization behavior, a brilliant addition whose experience guided the project through many land mines. The most critical addition to the project was the assignment of a member of the Vice Chancellor's staff to the team. This individual cut through bureaucratic red tape whenever any of the numerous obstacles of the project began to raise serious opposition to the project. Budget issues were always a concern and negotiations among the campuses, the Chancellor's Office, and state agencies required intervention at the highest levels of administration.

The first task of the Technical Team was a Needs Analysis Survey. A twenty page survey instrument was developed, and all 19 campuses responded - quite an achievement! After a systemwide analysis of the data was made, a preliminary conceptual model was developed of the proposed maintenance system. The related procedures and tasks were consolidated into several modular subsystems. A set of detailed specifications was developed and, along with a general description of the conceptual model, was transformed into a Request for Information (RFI). The RFI was sent to over 60 potential vendors, and received 20 responses. An evaluation of the responses allowed the Technical Team to fine-tune and adjust the rough points of the conceptual model so that it more nearly reflected the actual requirements. The Technical Team did not want to rewrite the new system's programs.

Before the State would approve the project for inclusion in the budgetary process, a feasibility study had to be developed. The study contained a detailed analysis of minute tasks and projected associated benefits and savings that could be realized through an automated system. It was impossible as well as unacceptable to develop savings based on long-term benefits, such as extending the life of equipment and providing more complete preventive maintenance. The absence of any existing historical data covering the down-time of equipment, the replacement of machines, unmet backlogs, etc. eliminated any frame of reference from which improvements of the new system might be compared. Definitely the control agencies challenged the integrity and creativity of the authors of the feasibility study.

A natural extension of the previous efforts was the Request for Proposal (RFP). It contained the final version of detailed specifications along with administrative requirements of the procurement. Points were assigned to each of the features of the application in order to weigh their relative importance. Fifteen bid responses were received. The three vendors with the highest point-to-cost ratios were selected for a validation demonstration. After each system was scrutinized carefully, the award of the contract was made to the overall lowest bidder.

With the arrival of the behaviorist, more attention was directed toward training, documentation, and user manuals. Few vendors gave this aspect of their products adequate, if any, thought. And certainly, the user materials were not oriented to customers in higher education. Hence, additional negotiations were required to bring the training aspect and manuals up to a standard appropriate for every employee who would be involved in the new Maintenance Management System.

THE POST IMPLEMENTATION AND EVALUATION REPORT

One year after the installation of the hardware, the Technical Team visited each campus to determine the degree to which each campus was achieving the performance objectives identified in the feasibility study. Also, there was interest in ascertaining what secondary effects might be realized through MMS.

The survey instrument was divided into six major modules:

** The Installation Process

** Influence on Management of Plant Operations

** Program Results

** Organization Impact

** Cost Control Factors

** Long Term Support Requirements

The data collected from the above survey suggest the following critical success factors:

- Management Commitment. Those campuses without a strong management interest fell significantly behind those that did. In some cases, the management was changed.

- Campus Redirected Resources. Those campuses which chose to upgrade their hardware immediately and add additional personnel in the Work Control Center advanced their progress significantly beyond those that didn't.

- Product Champion. The identification of a key promoter to champion the cause for the change was evident on many campuses. This person usually worked excessive hours forcing the system to perform well and absorbing much of the pain associated with new implementations.

- Technical Support for the Computer Center. Many plant operation units sought and received technical assistance from their local computing facilities. The presence of some vendors' equipment in the Computer Center meant that operating characteristics were identical.

- Site Visits. Prior to installation, the Technical Team spent two days on each campus reviewing conditions and sensitizing the management to important issues.

- Implementation Plan. This document communicated the entire scenario of the project to the campuses. Broad participation from campuses in the creation of the plan insured acceptance of the plan.

- Training. Major emphasis was placed on a thorough, extensive training program, easy-to-read user manuals, and complete operational documentation.

- Hotline. Campuses called the vendor's technical assistance service and received quick, responsive answers.

- Post Implementation Survey. Campuses were motivated to demonstrate their progress with MMS. A spirit of competition prevailed among many managers.

During interviews with the plant operations directors, they report that they have noticed:

* Improvements in identifying and tracking chargeback work;
* Increased productivity;
* Better labor accounting;
* Tighter material control;
* Closer inventory control;
* Improved scheduling and management of the work;
* No loss of work orders;
* Higher work order completions rates;
* Better coordination of the trades;
* Improved accountability of supervisors;
* Development of a comprehensive inventory of maintained items;
* Documentation of equipment performances;
* Improved relations with clients;
* Higher visibility of problems;
* Improved availability of material as needed;

On the other hand many customers report increased effectiveness of plant operations in such matters as:

Better scheduling of projects;

Improved closure on work orders;

Better estimates on chargeback projects;

More rapid response to service requests; and

Better planning, scheduling and execution of the w .k.

In summary, the new Maintenance Management System has been a stimulus for:

* The creation of new policies;
* The reorganization of the central administration;
* Classifying and documenting procedures;
* Developing improved standards of performance;
* Improving the ..ccuracy of accounting for labor and materials;
* Tighter scheduling and tracking of work flows; and
* Controlling and maintaining warehouse inventories.

In conclusion, MMS has been successful far beyond the expectations of its originators; it has raised the self esteem and personal confidence of those closely identified with the project.

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"HELLO, I'M NOT AT MY DESK RIGHT NOW..."

A Whimsical Look at the Use and Misuse of Voice Messaging and Menu Systems

The implementation of new voice communication technology prior to having a carefully thought out plan can introduce a variety of new and often frustrating issues to the corporate and public users of the system. Voice messaging systems and automated call routing systems are powerful tools which may enhance user productivity and expedite call processing. However, callers may get "lost in loops" and find themselves in "voice mail jail" if the system features are not properly implemented. This presentation explores this new enhanced call processing technology and offers some tips on what makes some implementations effective while others become public relation disasters.

John True, Director
Computing and Communications Services
San Francisco State University
September 1988

'HELLO, I'M NOT AT MY DESK RIGHT NOW..."

A Whimsical Look at the Use and Misuse of Voice Messaging and Menu Systems

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Did you hear about the former boss who tried to send a very personal romantic voice mail message to his sweetheart in another office and sent it to the department group distribution list by mistake? Or about the new way unmarried Yuppie couples refer to their cohabitation arrangement as being in "phone message synch"...?

The implementation of new voice communication technology prior to having a carefully thought out plan can introduce a variety of new and often frustrating issues to the corporate and public users of the system. Voice messaging systems and automated call routing systems are powerful tools which may enhance user productivity and expedite call processing. However, callers may get "lost in loops" and find themselves in "voice mail jail" if the system features are not properly implemented. This presentation explores this new enhanced call processing technology and offers some tips on what makes some implementations effective while others become public relation disasters.

First, we'll take a look at voice mail including its purpose, features, uses and misuses as well as what's involved in the administration of a system. Then we'll examine automated call routing systems which are also known as "automated attendant" or "enhanced call processing" systems.

The noble purposes of voice mail systems include avoiding telephone tag, providing information to callers, and increasing productivity. Telephone tag can be avoided by leaving detailed messages rather than call-me-back messages. In this way, one can actually conduct business activities without having to have a meeting or a two-way conversation with the other party. It goes without saying that highly confidential messages should not be entrusted to voice mail. Information, such as the time when you will return from a trip, may be provided to callers as a courtesy in your greeting announcement. Productivity gains result from being able to receive and act on messages at your convenience.

Other features supporting productivity include group distribution lists allowing, for example, a secretary to remind several people of a meeting by recording one message and entering the code for the group distribution. Our institution recently used the broadcast announcement feature to simultaneously notify 1800 voice mail users across campus about the selection of the new campus president. Having off-campus access to one's voice mail messages is a feature which many users have found productive. Some systems even offer a return receipting feature so that the message sender is notified that the message was heard by someone with access to the receiver's mail box. This is one way to avoid "executive lying" (e.g., "I never got your message").

So you've decided to give voice mail technology a try. Here are some tips on system acquisition and administration. System capacity is rated in terms of storage hours; it's really only a digital mass storage device. There are usually at least three primary parameters which the system administrator may adjust. These are the length of each message, the number of messages an individual may have stored at any time, and the number of days for which a message will be retained. Sets of these parameters may be grouped together into classes with similar characteristics. Our campus has a class called faculty that permits up to 50 messages of up to 2 minutes each which are retained for up to 17 days. To determine the required system capacity, multiply the user parameters for each class by the number of users in that class. This formula leads to a calculated disk storage far in excess of actual requirements because disk space is dynamically allocated. Over-subscription ratios of twenty or thirty to one are not uncommon based on the general statistic that the average user will utilize less than four minutes of storage at any one time.

Campus politics may come into play in determining who gets a voice mail box. Will the custodians be insulted if they don't get a mail box? Is any employee a second class citizen if he or she is not allocated this resource? We found that part-time faculty who often have limited, if any, office hours use this system to communicate with students who otherwise would have to wait several days until the next class meeting. Our recommendation is to give a voice mail account to every individual and office that has a telephone.

Watch out for hackers (yes...HACKERS)! The diabolical sophomore syndrome is present. You are not paranoid. They are out there trying to gain access to and control your system. An article in the September 12, 1988 issue of Network World stated: "A wholesale grocer (in Los Angeles) recently fell victim to a small band of hackers that commandeered the firm's voice-messaging system and used it to run prostitution rings and pass information about drugs." At our campus, faculty voice mail boxes were pre-initialized one month prior to the return of faculty for the fall semester. The initial password, to make login easy, was set to the same number as the four digit telephone extension. Clever! Right? When the faculty arrived and tried to open their voice mail box, they found that Zorro and Darth Vader owned their accounts. Our recommendation is to use no less than six digit passwords and change them periodically.

If you are sold on voice mail, remember that there will be some who are not. Voice mail is a tool, like campus mail, that may or may not be appropriate for every situation. Once our Vice President learned that many phones in the Accounts Payable office had been forwarded to voice mail and vendors wanting to talk to a human about outstanding invoices were not impressed, he decided that was not an appropriate use of this technology. When the Executive Assistant to the President needed to talk to a Dean about the conduct of a faculty member , he felt uncomfortable leaving a "detailed message." Our recommendation is to be prepared to remind those who complain about the technology that they simply should not make use of it.

Automated attendant or call routing capability is sometimes packaged with voice mail systems. It is also sold as a separate enhancement to your voice communication system. The purposes of call routing systems include providing information to the public and call expediting. In theory, more calls can be processed without additional operators. This technology can actually provide a disservice to callers if not properly implemented.

In a complex organization it is tempting to try to have each unit referenced in the main menu or the sub-menus of a call routing system. However, from the perspective of a caller who may not be familiar with your organization, this may appear as a great maze with few clues as to the way out. For example, a high school graduate calling to check on his or her admission status may not be sufficiently familiar with the language of higher education to know whether to press "1" for undergraduate or "2" for graduate admissions. After all, the person did graduate from high school. Similarly, does one calling for information really know the difference between the Counseling Center and the Advising Center? There is a new chant emerging across the nation that cries out: "Let me talk to a real person."

On the other hand, if a large percentage of calls to the main switchboard request either the admissions office or directions to campus, then one has the perfect requirements for a simple call routing application menu with those two options plus a live operator default. The admissions option could then have sub-menus with option "1" being a recorded announcement of deadlines, financial aid procedures, housing procedures. etc. The press "2" directions-to-campus option could transfer to a recording which could also include information about current events on campus. The live operator default could be routed to an automatic call sequencer which advises the caller that his or her call will be processed in the order received. Our recommendation is to have no more than three or four main menu options and with each having no more than one sub-menu. Each menu, main or sub, must offer the caller an option to connect to a live person.

Looping or getting trapped in the voice mail jail is a potential problem for your callers. Even though you think you have a perfect menu branching design, an unplanned loop may occur. In the scenario above, if the admissions real person in the sub-menu is already on a call, where does the call router transfer to? If it goes back to the main menu, you've lied to the caller who's expecting a live person. Similarly, if that admissions clerk is on break, does the transfer go to the clerk's voice mail account which again is not a live person?

If your PBX is from one vendor, your call router from another, and your call sequencers from yet another vendor, you may experience some hardware/software incompatibilities that will cause your perfect call routing algorithm to behave strangely. For example, our call sequencer does not truly release a call which an operator has transferred but keeps that particular sequencer trunk tied up until the conversation is terminated. As a result, we had to acquire a larger capacity sequencer. A "feature" of our call router is that it will not give up if it can't complete a transfer. The result is that a caller may be returned to the main menu if the option selected is not available to respond.

In summary, we have highlighted some strengths and weaknesses of voice mail and call routing systems. This technology provides some wonderful opportunities for your organization but has some potential threats. We hope the recommendations for do's and don'ts will be of assistance. The final advice is to start out slowly with planned phases. We tried to implement a new voice switch, a new voice mail system, a new prefix, a new call routing system with a complex menu, and a new campus data backbone network at the same time. Needless to say, we confused and upset a lot of folks. The lesson, to paraphrase a wine commercial, is that one "should serve no technology before its time."

This session is intended to be a sharing of information activity. We would now like to hear about experiences with this technology from other institutions.

Going to Extremes: A Statewide System SIS Implementation During Funding and Structure Instability

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ABSTRACT

This paper focuses on the radical restructuring of Alaska's public higher education system brought on by the State of Alaska's 1986 economic collapse which occurred in the middle of implementing a statewide student information system. The restructuring created three multi-campus institutions from a system originally comprised of three universities and eleven community colleges over a two-year period. Coordinating a major statewide information system development effort initially designed for an education system comprised of established and finacially secure four-year universities, community colleges, and an array of rural and distance delivery instructional components is a challenge itself most states would find difficult to undertake. Compound it by simultaneously altering the University system structure by merging open-door admissions community colleges with four-year traditional universities, redesigning core curriculum and course numbering schemes on a global scale, rewriting all academic rules, absorbing a 24% general fund budget reduction (33% if state student loan funding is included), adjusting to the elimination of two out of five admissions and records offices and their accompanying staffs, and going through two iterations of student record conversions before the final system structure stabilizes. Taken together, the constraints encountered by the student information system project at the University of Alaska prompted the development of a non-traditional approach toward involving users from each campus in the system in all aspects of the systems development effort. Embracing this user perspective toward project management enhanced both the system design and campus commitment toward a successful development effort, established effective project team communication, and helped reduce the risk that non-data-processing tasks would end up on the project's critical time path and result in cost overuns. Now, fully one year after bringing SIS online, the approach taken by the project team continues to enable a smoother evolution of SIS as changes in the University organizational structure stabilize.

INTRODUCTION

In late 1985 and early 1986, world oil prices collapsed. Wellhead prices for oil fell from $28 per barrel in January, 1986, to below $10 per barrel in August, 1986. In a short period of time, the State of Alaska, whose budget was more than 86% dependent upon the price of oil, saw its total state revenues drop by more than one-third. The governor and state legislature were forced to curtail state spending several times. For Alaska's statewide system of higher education, falling state oil revenues brought budget cuts -- four percent in FY86, ten percent at the beginning of FY87, another ten percent in the first month of FY87, and another initially proposed fifteen percent reduction scheduled for FY88.

Spurred by real and proposed budget cuts, in December of1986 the University of Alaska Board of Regents approved a massive restructuring of Alaska's statewide system of higher education. The restructuring plan called for a merger of eleven community colleges with three universities into three multi-campus institutions. The plan realigned statewide programs in vocational-technical education, fisheries and ocean sciences, international business, and rural higher educational delivery. It called for the merger of a unionized community college teaching faculty with a non-unionized University faculty. The plan anticipated termination of nearly one hundred administrators and an additional five percent cut in system costs without significant impact on program delivery. The plan was controversial. It spawned litigation, legislation, arbitration, and a 1988 voter initiative. Now, two years later, the major elements of restructuring are complete.

This paper will present how the University of Alaska System addressed these extreme and sudden reductions in state appropriations and how this affected the implementation of an online student information system (SIS) which was just eight-months away from going live when the crisis hit. It will trace the factors which required that restructuring be considered, document the restructuring decision-making process, detail the process of carrying out the restructuring plan, and assess the impact on the SIS to date.

Factors Leading to Restructuring

For twenty years, the fortunes of the State of Alaska have been tied to those of the OPEC oil-producing countries. As one of the United States' most significant petroleum-producing regions, Alaska benefited from the 1973 and 1979 increases in oil prices. Nearly all oil production in Alaska occurred on state-owned land, yielding royalties, and all production was subject to severence and income taxes. The value of oil production so overwhelmed other economic activity that the state became highly dependent upon petroleum income as a source of state revenues.

Among the principal beneficiaries of new state wealth were the public education system and the statewide system of higher education -- the University of Alaska. A single University in 1970 , it grew to two, then three universities while the number of community colleges in the system grew from two in 1970 to eleven by 1979. In 1980, the University system began its first $100 million state-funded budget, which increased to $168 million by fiscal year 1985.

In 1980, the system was organized into six major administrative units:

- The University of Alaska-Fairbanks (UAF), the original University, with strengths in natural sciences, a strong research program in life sciences, marine sciences and geophysics, the only doctoral programs in the state, and a residence-based student body.
- The University of Alaska-Anchorage (UAA), a young comprehensive urban University with emerging graduate programs and new residential housing, struggling to overcome a "little brother" image to UAF.

- The University of Alaska-Juneau (UAJ), a small four-year college, formed by the 1978 merger of a four-year institution and a community college.
- Anchorage Community College (ACC), the state's largest community college with strong vocational and academic transfer programs and a student population of 10,000.
- Community Colleges, Rural Education and Extension (CCREE), a mini-system within a system based in Anchorage, including ten community colleges ranging in size from Chukchi Community College in Kotzebue (60 FTE) to Tanana Valley Community College in Fairbanks (750 FTE), rural education centers in a dozen rural villages, and the Cooperative Extension Service.
- Statewide Programs and Services, including the system administration offices, the Sea Grant College Program, and the University computer network.

By early 1985, the oil bubble began to shrink. Oil prices softened. The University of Alaska Board of Regents, foreseeing a period of little or no growth, called upon the administration to develop a new six year plan based on reduced expectations. The 1985 Alaska legislative session saw the first real reduction in state funding for higher education -- the University system was forced to make $7 million in reductions to pay for a $7 million cost-of-living increase for University employees. The budget stood at $168 million.

Over the fall of 1985 the University began the process of belt-tightening, shaving budgets wherever possible. While budget-cutting is always painful, most observers saw enough slack in the budget to cut expenses without major program effects. By December, however, oil prices began falling more sharply. The University's President created a Budget Flexibility Task Force of University administrators to look for further belt-tightening opportunities. In January, 1986, the tumble in oil prices became a free fall. By March, revenue projections were down more than 25 percent. Alaska Governor Bill Sheffield called for a freeze on state hiring and other measures designed to save money for the remainder of FY86. The University followed suit, targeting a $2 million reduction in spending (five percent of remaining funds) for the final three months of the fiscal year.

The budget for fiscal year 1987 would certainly be worse. The Governor called upon the University to reduce spending by $15 million, or nine percent; after some wrangling the legislature approved the cut. The University responded with a plan which called for reductions in out-of-state travel, elimination of all equipment purchases, a reduction in pension benefits for staff, a tuition increase, limited program reductions, and the elimination of statewide programs in nursing, a phase-out of the WAMI medical education program, and significant reductions in institutional support and academic support personnel. The plan called for elimination of 250 jobs, 175 of which were filled at the beginning of the year, and the closing of two of five admissions and records offices in the system. The University entered the new fiscal year under difficult financial conditions, with a general fund budget of $153 million.

fter the Alaska Legislature adjourned, state revenues fell further. On July 17, 1986, the Governor announced a general budget rescission for state agencies, giving the University a fifteen percent, or $23 million reduction. The President notified the system chancellors that he was forming a Restructuring Team to "gather information needed for refining the statewide system and campus missions based on the strengths of each campus and the elements which permit it to be of special value to the region that is served."

The Restructuring Decision-Making Process

In early August, the Governor changed the rescission target to $15.3 million. The University President reported to the University community on the planned response to the Governor's request. After meeting with the five chancellors, the President would recommend to the Board of Regents a package which included:

- $9 million in reductions to teaching, research and service programs
- a declaration of financial exigency, allowing the University to reduce compensation for

non-represented employees by $8 million, including reductions in teaching contract lengths
- increases in miscellaneous fees and parking charges
- restructuring of the system to "make it a smaller institution, offering fewer services to a more limited range of citizens, but retaining its quality and reputation, and preserving a basic structure on which it can build when the state's economic situation improves."

The Board of Regents balked at the declaration of exigency, believing it would produce permanent harm to the University system. After an emergency meeting with the governor, the regents agreed to lapse $6 million in unspent capital appropriations, with a commensurate reduction in the budget rescission. Staff salaries were frozen and benefits were reduced. The agreement anticipated further reductions in the following fiscal year.

On October 31, 1986, the President unveiled his proposal to the Board of Regents. It called for three multi-campus universities, which would merge the open-access community colleges with traditional University institutions. The new structure would have the following features:

- In Southeast Alaska, the University of Alaska-Juneau and Ketchikan and Islands Community Colleges would be merged into an undergraduate college with a regional mission offering developmental courses and associate and bachelor degrees, providing graduate programs by extension from Anchorage and Fairbanks, and receiving vocational-technical programs from Anchorage.
- In Northern Alaska, the University of Alaska-Fairbanks which provided undergraduate and graduate programs would merge with Tanana Valley Community College. As part of this institution, a new rural college would merge the rural community colleges (Chukchi, Kodiak, Kuskokwim, Northwest, and Prince William Sound Community Colleges) and the extension centers with responsibility for vocational-technical programs, associate and bachelor degree programs. The Cooperative Extension Service would be associated with UAF colleges.
- In Southcentral Alaska, the University of Alaska-Anchorage and Anchorage Community College would merge. The Matanuska-Susitna and Kenai Peninsula Community Colleges would merge with this unit, offering instruction at the associate, baccalaureate and masters level. A new statewide vocational-technical unit would be formed from the Anchorage Community College program, offering elements of the program throughout the state.
- Once the new institutions were well established, the Statewide Administration would play a narrower and more policy-oriented role.
- A new statewide fisheries and marine science faculty would be created, merging programs throughout the state under the new northern institution. A similar faculty unit for international business would be based at the southcentral institution, and health and medical education and research would be centered at the Anchorage campus.

The public response was immediate and intense. Community college councils, the unionized community college faculty, and concerned citizens attacked the President and his plan. At public hearings throughout the state, hundreds of people criticized portions or all of the plan. A coalition of opponents, the Community College Coalition of Alaska, was formed. Opponents saw the plan as denying the mission of community colleges, changing the nature of the college commitment to students, removing the community service role of the local administrations, abridging local control and autonomy, and possibly breaking the community college teachers' union.

In December, the Board of Regents modified the plan, shifting Kodiak and Prince William Sound Community Colleges to the new Southcentral Institution and making other programmatic changes, then approved the plan and new structure. Significant changes included plans for allowing communities which

provide a traditional community college funding base to keep local control, plans for assuring the community college mission was maintained, realignment of some extended colleges, and priority given to remedial/developmental and core lower division courses and programs, and bachelors' level courses and programs at the current community college locations. In Anchorage and Fairbanks, new colleges were created within the universities to provide continuing education, vocational training, and certain other functions of the former community colleges. The regents asked the administration to prepare regular reports on programs at each community which previously had a community college. Several major policy issues were identified at the regents' hearings, which became recurrent themes during the ensuing months. These included:

- Protection of the community college mission
- Integration of the unionized community college teachers with the non-union University faculty
- Integration of programs between community colleges and universities
- Maintenance of accreditation of programs and institutions
- Maintenance of community-based advisory structures

The Restructuring Process

The restructuring implementation process was to include three phases: (1) consulting groups, consisting of University and community college administrators and staff and representatives of external constituencies, would draft solutions and responses to major issues, to be approved by the chancellors and regents, (2) institutional restructuring advisory committees would develop detailed plans, creating special task forces as necessary, (3) systemwide task forces on rural program delivery, fisheries and ocean sciences, and vocational-technical education would plan organizations for these new units.

While overseeing this implementation process, however, the President's Restructuring Team found that external battles occupied much of its time. When the legislature convened in January, 1987, bills were introduced to separate the community college system from the University. Lawsuits were filed by a school district and by the Community College Coalition. By March, the Coalition announced an initiative campaign designed to separate the community colleges.

At each meeting of the Board of Regents, further refinements were made in the overall restructuring plan, and specific problems were addressed. The regents approved a policy allowing communities which provided through local funding and tuition at least 1/3 of the local campus budget to maintain a semi-independent community college, with a local administration much like the institutions which existed prior to restructuring. The only community which qualified as of 1987 determined it would keep Prince William Sound Community College under this policy.

The legislature adjourned without action on the separation bills, but the State House passed a resolution asking for reconsideration of the restructuring plan. The University budget was approved at $137 million, with an additional $4 million in restructuring transition funds approved from University interest income. The budget structure followed the lines of the restructuring plan, calling for $6 million in savings from restructuring, $6 million from permanent program reductions, $8 million from compensation reductions, and restoration of $9 million of the emergency reductions made in the previous year. The budget included nearly 50 "legislative intent" statements, asking for protection of the community college mission, for reporting on all events related to restructuring, and creating a special interim committee to oversee and report to the 1988 legislature on the restructuring process.

In May and June, 1987, the regents tackled what had become the most significant problem -- merging of the two faculties. Under the terms of the collective bargaining contract, the University could not force union members to become part of the University faculty. It could offer transfer opportunities, and management had the right to create or eliminate community colleges. The University offered to bargain over the effects of restructuring, but the union insisted on bargaining over the restructuring decision. Some talks were held, but no bargaining commenced. In early June, the regents voted to offer transfer

opportunities to all unionized teachers. The offer generated opposition from both community college and University faculty.

The union filed a grievance the next day, alleging the University had unilaterally altered a major policy by eliminating the entire community college system, thereby negating all provisions of the collective bargaining agreement. The University denied the grievance, and it was submitted to arbitration. All but one community college faculty member signed the transfer papers, although many added protest notes. The community college faculty also filed an unfair labor practice charge against the University, alleging willful refusal to negotiate anything but "effects" bargaining, changing salaries and workload without bargaining, changing working conditions, discrimination against union members, failure to present the entire plan to the union, conducting individual bargaining with union members by offering individual reassignments, refusal to recognize the union as the elected representative of employees, and "anti-union animus" by the president. The unfair labor practice decision process was held in abeyance, pending the arbitrator's decision on the union's grievance.

The regents also adopted policies governing the merger of institutions and reduction of institutional support positions in the new institutions. Policies were created to ensure that where several individuals held similar jobs in the old institutions, each would be considered for the job in the new institutions. Those not selected would be laid off, with certain rehire rights. Of the five SIS campus implementation coordiantors, only one remained employed at the University after this phase of the restructuring.

On July 1, 1987 the new institutions came into existence. The process of combining administrations began. It was most severe in Anchorage, where the three old administrations of the University of Alaska-Anchorage, Anchorage Community College, and the Community Colleges, Rural Education and Extension division were to be merged under a single chancellor. The process for merging administrations provided for notice of "affected position" to all persons holding similar jobs, determination of the best qualified from among those affected, and layoff notices to those not chosen. Systemwide, nearly 100 positions were eliminated, including two chancellors, five vice chancellors, eight deans, 19 directors or campus presidents, and a host of coordinators, managers, other administrators, and clerical personnel.

The legislature convened in January, facing an initiative and separation legislation brought forward by the Community College Coalition. In February, the University won a major victory when the grievance arbitrator ruled in the university's favor, stating the restructuring was a "legitimate and proper" response by the University to its funding circumstances. In May, the Superior Court judge hearing the initiative lawsuit ruled in the university's favor on the appropriation question, removing the initiative from the fall ballot [no decision was made on the vagueness question]. An appeal to the Alaska Supreme Court reversed the lower court's decision, and this past November, 1988 the ballot measure to separate the community colleges from the University System was rejected by the voters.

Positive outcomes of restructuring for students are significant. For students in Anchorage, there is now one SIS registration process for all students, rather than separate processes for Anchorage Community College and the University of Alaska Anchorage. Movement from branch campuses to the main campuses in Juneau, Anchorage, and Fairbanks is now a within-institution transfer, rather than a transfer to a new institution. A simplified course numbering scheme implemented with SIS makes understanding of courses and programs significantly easier for both students and faculty. Students now have a single tuition structure within Anchorage and Fairbanks, rather than a dual community college - University tuition structure. Academic advisement should improve, as advisors can deal with all courses taken by a student, rather than only courses taken at the advisors' separate institutions. Students at branch campuses and in rural Alaska have seen new benefits beginning this fall. Selected upper division and graduate courses are now offered at the branch campuses in addition to the vocational-technical and lower division courses formerly offered by the local community colleges. As demand warrants, full degree program sequences are likely to be offered in education, business and management. Cooperation among the rural colleges in the use of distance delivery technology will make courses formerly offered in only one community or

region available throughout rural Alaska, increasing student course choices.On the negative side, some non-traditional students believe that even with open door policies, institutions called universities are not as student-centered as community colleges and will thus provide less service to students.

For faculty, the results are mixed. Benefits include the bringing together of faculty that had been in a more isolated educational environment to form a more functional critical mass. A new governance structure increases the visibility and role of faculty in decision-making at the three new institutions, while continuing the faculty participation in the Statewide Assembly of University faculty and staff. Faculty in small departments and disciplines are gaining the benefits of a wider circle of peers. Some University faculty are concerned about the quality of instruction at the former community colleges, and are reluctant to accept transfers of students into baccalaureate programs. Some are worried about an erosion of quality at the upper division level, since the Board of Regents has placed such a large emphasis on maintenance of the community college mission. On the downside, the volume of issues facing faculty has increased dramatically. Development of new policies for evaluation, promotion and tenure has required increased faculty participation in committee meetings. Each department at each institution has faced problems of integrating curricula of two or more institutions, changing course content to allow simplified course numbering and unified course content descriptions. Many faculty members will be required to move, particularly in Anchorage where many departments are currently split between the old ACC campus and the old UAA campus. The strong committment of the traditional community college in Anchorage will continue to make it difficult to achieve full integration of programs and services, although many gains have been made.

The process took its toll on senior administrators. The survivors of the administrative combination in Anchorage were overwhelmed by the magnitude of changes planned, and had continuing difficulties effecting the merger of academic programs and faculty. In December, 1987, the Faculty Senate passed a vote of "no confidence" in the UAA chancellor. In February, 1988, the President reassigned the UAA chancellor, taking the assignment on himself. The system Provost also became a dual office-holder, taking the UAA academic leadership in addition to system academic leadership. Individual grievances and lawsuits multiplied.

HOW THE SIS IMPLEMENTATION TEAM ADAPTED TO THE RESTRUCTURING AND BUDGET REDUCTIONS

Develop A Project Organization That Involves Users - More Than Just Lip Service

Most administrative data processing development projects have historically revolved around the computer centers and have been directed by technical staff. The users, historically, were not brought into the basic system planning and design tasks by the data processing department. The University's SIS implementation team changed its system implementation philosophy by putting the general system design responsibility with the users. To accomplish this, the team adapted an organizational structure for project development efforts that included a management advisory committee (MAC), representatives from each major academic unit (MAU), a Training Team, and a Project Team. The MAC was comprised of top level administrators from each campus and were primarily the academic vice chancellors from throughout the system for SIS. The MAU committee members were the campus coordinators for the subject area being addressed by the project, from each of the units. The Training Team was composed of typical users from each of the units. Lastly, the Project Team itself was composed of members of the user community addressed by the project subject area, and included the Project Director who was ultimately responsible for the success or failure of the entire project.

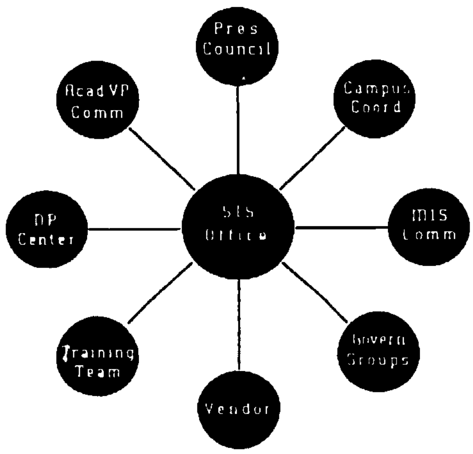
The Student Information System project developed these relationships and moved ahead to implement a system recognizing the needs of users, balancing that with the technological capabilities that were available as solutions to user requirements. During this ***transition*** to project management by users, it

became important that users increasingly feel responsible for and direct the activities of the project. At the same time, it was important that data processing present a clear statement of alternatives and consequences from a technical standpoint so that decisions were made that considered all the trade-offs, both in system functionality and technical/cost impacts.

Clearly Define a Decision Making Process - Link Responsibilty with Authority

Because of the varied nature of the University, the involvement of multiple campuses whose structures and relationships were changing, the decision making process could, and at times did, become complex and cumbersome. It was important to involve as many people as possible at the appropriate times to gain input and to assist in reaching a decision. However, decisions still had to be made and the old proverbial expression "being designed by a committee" could of had its consequences in this structure as much as any other if not managed appropriately. It remained extremely important that decisions be reached in a timely, straightforward manner if the project was to be completed on time. In the implementation of the SIS project at the University of Alaska, this process occasionally took longer than was desirable. It has been shown repeatedly throughout the implementation process that the time spent was worthwhile for the SIS project. It was necessary, however, to guard against letting it become a deterrent to getting the job done. This was accomplished by setting deadlines and using microcomputer project management tools such as PERT models and Gantt charts, so everyone knew who was dependent on whom. Within the organizational structure in place at UA, the actual decision making still had to be made at the Project Director level with approval through normal administrative channels. The multiplicity of decision groups the Project Team had to coordinate through indicates the degree to which this guaranteed user review.

COORDINATED DECISION GROUPS



Use State-of-the-Art Technology Effectively - Don't Skimp on User Training

When the University of Alaska embarked on upgrading its administrative computing capabilities, it issued an RFP for a Student Information System (SIS) and a Human Resource System (HRS) with associated hardware. The results of the RFP were the selection of Information Associates' SIS and HRS systems and an IBM 438I-2 mainframe. Also part of the process was to select programmer productivity tools and user support tools which would allow the users to perform much of their data processing functions without having to rely on the technical expertise of the programming staff. The RFP process resulted in the use of personal computers as workstations in order to provide a backup capability in the event of a disruption in the communications network or in the Control processing unit. Another purpose for the use of the micorocomputers is to provide a micro to mainframe connection that allows the downloading of information from the mainframe to microcomputers for data analysis.

As part of the software that was obtained, Cullinet's IDMS Management System was purchased, along with the associated products for development. These were used extensively for modifications as well as enhancements to the SIS package. Users have assumed responsibility for many of the ad hoc reports utilizing SAS, query languages, and other 4th generation tools that have been made available. As part of this, the project team put into place a support mechanism for training and assisting users in the application of these products.

Utilize Project Management Tools - The Secret Weapon in a Complex Environment

The key to making a successful transition from DP managed development projects to user managed projects is effective project management which integrates the strengths of both the data processing professional and the functional user. At the University of Alaska, this process began with compiling the administrative systems RFP where both programming and campus administrative staff collaborated. The user role was continually expanded from bid finalist site visitations through the identification and prioritization of software modifications. The manner in which software modifications were identified, used to construct implementation alternatives, and how project tasks were communicated serves as a good example of how project management techniques were used to integrate user and programmer.

In the spring of 1985, University of Alaska campus chancellors requested that the SIS project director develop a number of system implementation alternatives that would clearly present the trade-offs for each alternative in terms of functionality, required resources, and full system live dates. The major objective was to try to find areas which could be changed in order to allow an accelerated implementation schedule ahead of the originally estimated Fall1987 date.

A four-phase process was followed to facilitate the completion of the analysis in the timeframe provided:

- **Phase I - Identify SIS Modifications**
  In order to understand the software product the University had bought in relation to possible modifications that might be needed, the SIS Training Team comprised of campus users had to first complete SIS training. A number of meetings with campus, data center, and IA personnel subsequent to the end of the training period produced a list of two dozen required modifications to the base SIS system.
- **Phase II - Write Modification Specifications and Prioritize**
  A six question format, which incorporated both technical and functional questions, was developed to organize modification specifications in a comparative manner. The questions were: 1) what would we like to do, 2) what does the current system(s) do in this regard, or how do we handle it now, 3) what does IA's SIS currently have, 4) what alternatives do we have to satisfy the need for this modification, 5) what are the pro's and con's of each alternative, and 6) what is the recommended alternative, particularly in relation to cost, time, and manual impacts. MODS ID Teams, teams comprised of one campus user and one programmer, were assigned to every modification and were charged with compiling responses to each of the six questions for their modification. The most difficult aspect of the questions centered on the validity of the time estimates to complete any particular modification. No satisfactory numerical process was found superior to a best guess approach utilizing experienced users and programmers. All modification six-question write-ups were then studied by campus and central office representatives prior to being prioritized as being either absolutely necessary before turning the system on or not.
- **Phase III - Construct Multiple Implementation Scenarios**
  Four base scenarios were developed by varying the following variables: 1) whether one or multiple data bases would be used, 2) whether one or several independent copies of the SIS software would be used, 3) the manner in which campus differentiation would be handled, and 4) whether or not a phased approach to adding software modifications would be used. PERT (Program Evaluation and Review Technique) models were developed based on the

parameters imposed by each of the scenarios detailed as well as the modifications identified by campus users. A minimum number of set dates were used, thereby preventing the introduction of an excessive degree of slack, or unproductive wait time into each model. The models were used to refine tasks and task dependencies within the SIS development and design process and to calculate both pilot and full system implementation live dates.

- **Phase IV Rank Each Scenario in Relation to Impact Variables**
  The final phase included comparing the relative rating of each scenario in relation to the following eleven key impact variables: 1) separation of campus data, 2) centralized reporting, 3) campus reporting, 4) software maintenance, 5) standard data definitions, 6) data redundancy, 7) computer center hardware, space, and staffing, 8) campus staffing needs, 9) interfacing to other system, 10) time to implement, and 11) additional cost. Campus chancellors picked the scenario which mandated the use of one data base and one software copy which included only the modifications identified as being high and medium priority. The scenario chosen showed a Fall 1987 full system implementation date.

In each phase, campus users were either involved in assessing or designing functional system characteristics and modifications or in the final decisions concerning the project implementation schedule. The approval of the modifications and their descriptions also served as a first step in delimiting functional and technical modification specifications needed by the DP center and consequently helped save considerable time on these and succeeding tasks.

Once this implementation milestone was completed, project management techniques were also used to plan, communicate, organize, monitor, test alternatives, and assess project progress. All PERT systems use a network to graphically portray the interrelationships among the tasks and milestones (key dates, meetings, events) of a project. The network representation of the project plan also shows all the precedence relationships regarding the order in which tasks must be performed .

For the SIS project, three levels of PERT detail were designed with different user levels in mind. The first level, the overall project schedule comprised of the highest aggregation of tasks, was targeted primarily for executive administrators, particularly the academic vice chancellors that comprised the SIS management advisory committee, and their need to know the major project events. Tasks at Level 1 were assigned principally to the campus, the data center, IA, or the SIS Office. Level 2 schedules detailed major project tasks by campus and individuals within the data center and the SIS Office. These schedules were targeted primarily to assist campus SIS coordinators and programming managers with planning for major task deadlines. The most detailed chart, Level 3, listed tasks by individual breakdowns and was coupled with a Gantt chart of assignment descriptions, earliest task start dates, latest task end dates, and estimated task durations. The tasklists were used to structure daily work assignments for users and programmers.

The use of PERT for constructing various levels of project planning, control, and scheduling for different degrees of user involvement has been invaluable for organizing the systems development project, testing alternative plans, revealing the overall dimensions and details of the plan, establishing well-understood management responsibilities, and identifying realistic expectations for the project. Taken together, the various levels of task descriptions functioned to provide a structured process in which to ensure maximum participation from and maximum communication to campus users around the state. The large investment in time and effort needed, paid off in the highest possible user - programmer integration. It also enabled managing the miriad of last minute changes due to restructuring as tests were being run on the first two pilot campuses to receive SIS.

SUMMARY AND CONCLUSIONS

The implementation of SIS at the University of Alaska has been enormously successful. This is in spite of the fact that the University experienced the most dramatic general funding reduction to an entire state public higher education system since World War II. This success has become even more apparent since

the system has gone live. The system was implemented using the old University structure of 14 separate institutions. Immediately following implementation it was necessary to accommodate restructuring by combining the 14 institutions into three Universities that encompassod the functions of the prior Community Colleges and Rural Education.

In 1983 the University determined it would manage its own computing environment which had been previously done by a facilities management firm. New hardware, operating system, application software, productivity tools and staff were needed and training was started. A project management methodology was developed that required user involvement. The hardware and the software were installed and the projects underway when the bottom fell out. It was because of the wide spread support of users and management acceptance that the projects continued under such adverse conditions. Everyone was committed to see the systems implemented even though some knew their jobs would be eliminated shortly after the heroic efforts of implementation.

This paper as much as anything is an appreciation for the support of these individuals who were committed to that goal. Numerous extended hours were required. Management continued to support the project although funding for user help during implementation was non-existent.

The system's flexibility is indicative of a strong planning and support mechanism with everyone working together in spite of numerous differences. The most important aspect of systems development is the quality and commitment of its people, including management. Without strong project leadership it would have failed. Without users support and commitment it would have failed. Others may have succeeded without following the same process but the University of Alaska succeeded because of the people and the approach, under the most adverse conditions possible. The process followed was:

- **Develop A Project Organization That Involves Users - More Than Just Lip Service**
- **Clearly Define a Decision Making Process - Link Responsibility with Authority**
- **Use State-of-the-Art Technology Effectively - Don't Skimp on User Training**
- **Utilize Project Management Tools -The Secret Weapon in a Complex Environment**

SIS has proven to be a flexible and responsive system for meeting the University of Alaska needs. It has been adaptable as enhancements and additional functions are planned that will make it more useful in meeting the needs of the operational and management users of the system.

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Track III
Financial Impact and Considerations

Coordinator:
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Although the cost of hardware per unit of output is decreasing, the costs associated with software, maintenance, training, and staffing compel close attention to the financial impact of integrating information technologies into an organization.

Papers in this track address financial management techniques such as funding models, project planning/project management, cost determination and justification strategies, monitoring and controlling project costs, and identifying alternative funding sources.

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Providing Applications Development Services in a Competitive Environment

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Many applications development (and maintenance) groups are moving from being overhead units to ones that must recover their costs from customers within the institution. In addition, they are finding themselves in a more competitive environment on two fronts: users who hire their own programming staffs, and outside consultants who sell their development services to users. This paper discusses one institution's experience, and will provide information that can be valuable to all managers. Some of the issues addressed include marketing and promotion, contracting with clients, project management, and time accounting and billing.

Introduction and Background

The provision of applications development and maintenance services is changing with the introduction of new technologies and organizational pressures into the university environment. The traditional development group is often faced with the task of restructuring itself in order to meet the challenges it faces if it is to continue to be a strategic resource to the university. These challenges, which have acted to change the monopoly position traditionally enjoyed by the central mainframe-based development group, must be recognized and turned to the advantage of the central group if it is to survive.

At the Massachusetts Institute of Technology (MIT), as at most universities, administrative applications development has until recently been provided exclusively by a department within the central data processing group. Information Systems (IS) at MIT provides a full range of services, including applications development and maintenance, data center operation, voice and data communications services, and end-user support. As recently as 1982, the central development group, now called Administrative Systems Development (ASD), had a virtual monopoly over the market for developing administrative or business systems. However, the introduction and wide-scale availability of mini-computers, followed shortly thereafter by personal computers, has brought other players into the market. In the days when the only available platform for running an application was on the large, centrally-controlled mainframe computer, IS maintained tight control over the development of those applications because of its ownership and control over the mainframe computing resources. Clients had no choice but to come to the central development group if they wanted to have a system developed or enhanced. With the advent of powerful minicomputers, though, those departments with a large enough demand for computing resources found that they could cost justify both the ownership and operation of a minicomputer, as well as the resources necessary to develop and maintain an application.

These large users who purchased their own minicomputers generally developed applications in one of two ways. If the demand for programming services was deemed to be of a short duration, with no need for ongoing applications support, then an outside consultant was often brought in to develop the application. After completion of the project, the consultant would be retained to provide a designated level of support and enhancements. Certain staff in the user areas would be designated as the "computer expert", and would be provided with minimal training to provide operational support on a day-to-day basis. Depending on the size of the minicomputer, it either would be operated at the data center by the central IS organization (if it required computer room facilities), or would be located in and operated by the user department itself.

As this migration away from the central development group was beginning, some users were able to create dedicated programming positions (often staffed by enterprising students) from within their own department. Thus, we soon had a mixture of consultants and client-owned programmers developing business applications for minicomputers, and shortly thereafter, personal computers. As with many other institutions, the next logical step (and one that was advocated very strongly by the client community) was the migration of some of the mainframe applications programmers from the central applications development group out into the client departments. Today, business applications development across all three platforms (personal computer, minicomputer, and mainframe) is performed by a mixture of the central group, outside consultants, and client-based programmers. This dispersion of responsibility is part of a trend described recently as ". . .the devolution of influence over IS activities, computer power and applications to user organizations. . .[caused by] company pressure for competitive systems, increasing availability of and familiarity with powerful desktop systems, and economic pressures to reduce IS expenses."[1]

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1 Kay Lewis Redditt & Thomas M. Lodahl, "Leaving the IS Mothership", CIO Magazine, October 1988, p. 56.

Parallel to this shift in the control over development resources have been demands for greater accountability and better performance on the part of the central group. Since it no longer enjoys the advantages of a monopoly, the central group has had to change to become more able to compete with other service providers. No matter whether the central group has operated on a chargeback basis, or strictly as an overhead (non-cost recovery) unit, survival in the competitive environment now depends upon the group's ability to adapt to its new challenges. Phrases like *market research, marketing, service level agreements, cost recovery strategies,* and *customer service,* which in the past have been all but unknown to the central development group, become key factors in the competitive environment.

Establishing Revenue Goals

The first step in the move towards the competitive environment is that of deciding upon the organization's cost recovery goals. Occasionally a change in strategy is proposed by the central group in response to its recognition of the need to compete with other service providers or because of perceived budgetary pressures; often the decision is thrust upon the organization by senior management of the university. There has been much emphasis recently in the press on MIS accountability and on making it "pay its own way", and universities have not been exempt from these tre.ıds. Simultaneously there has been a movement towards more sharing of the responsibility for systems development between MIS and the users of the system. At MIT for example, this sharing of responsibility has been described as follows:

- Central administrative departments serving as custodians (not owners) of central Institute data with responsibility to insure that the data are accurate, consistent, timely, and accessible.
- Central administrative departments with responsibility for all applications related to their areas of functional responsibility, where applications include those used within a central administrative department as well as across the Institute.
- Implementation and support of applications carried out, at the department's discretion, by a combination of Information Systems staff, vendors and the administrative department's computer support personnel.[2]

Regardless of the origin of the decision, clear and concise cost recovery goals must be established so as to provide a framework for the transition. Figure 1 below shows examples of various targets in the continuum from organizations that are purely overhead to those that are run as profit centers.

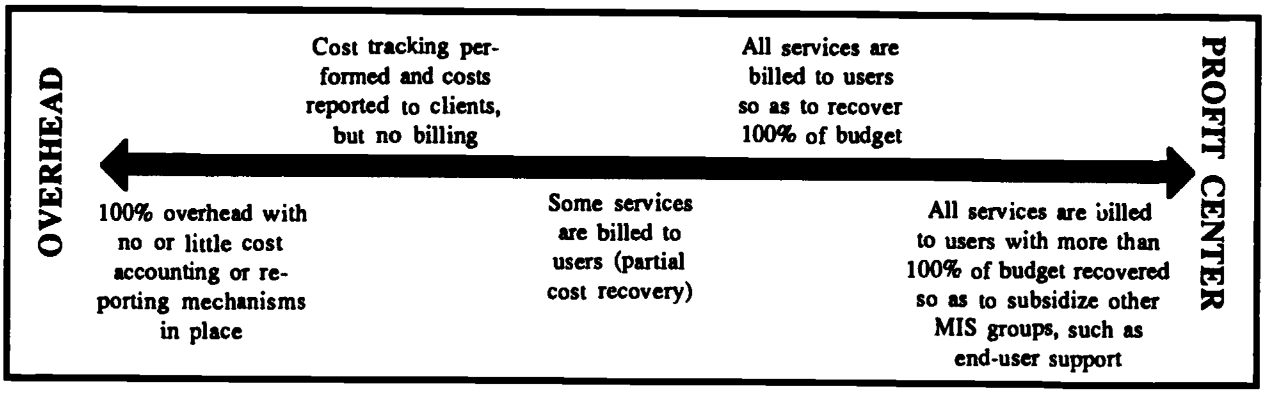

Figure 1

2 "A Proposed Administrative Information Systems Strategic Plan", MIT, March 1986, p.19.

The decision of where to target the location of the central development group on the continuum depends on the answers to questions like these:

- What is the precedent in the university for the chargeback of services by other central groups (such as buildings and grounds, telecommunications, or the data center)?
- What is the budget situation of the central group's clients? Are they mandated to be cost recovery units or are they strictly overhead units?
- What cost accounting mechanisms are in place or can be put into place (i.e., can/should services be recorded and charged hourly, per person-month, or person-year)?
- How much control over its costs does the central development group have? If the demand for its services drops temporarily, can it use layoffs or will staff have to be carried as overhead for a period of time because of university personnel policies?
- How strong are the pressures for decentralization of the group, and how available are substitute services?

There is no single formula that dictates where on the continuum the central development group should fall. However, there are advantages and disadvantages to each end of the scale, as well as the gradations in between. Figure 2 outlines some of these.

	OVERHEAD	COST RECOVERY/ PROFIT CENTER
ADVANTAGES	• No need for reporting of costs to clients • Provides a perceived cost advantage to clients over using other service providers • No disruption to the organizational structure and culture of the central development group	• Provides better understanding of the costs associated with applications development • Provides more incentive for clients to accept more responsibility for their role in development • Provides opportunity for funding other MIS functions indirectly • Provides more of a baseline for competing with other service providers
DISADVANTAGES	• Lack of metrics for comparing costs and performance with competing service providers • Devaluing of service by clients, i.e., the "you get what you pay for" syndrome • Less participation in the development process by clients	• Cost accounting/reporting/billing mechanisms have to be put into place and maintained • Charging for services may cause clients to examine other alternatives they would not have otherwise considered • The need to achieve certain revenue goals may cause instability in staffing, which could harm staff morale

Figure 2

At MIT, the decision was made to use a phased approach to move ASD from being a $5 million overhead unit to a 100% cost recovery organization. In the first year, ASD would charge for the maintenance and support of existing applications, while continuing to provide development of new applications from overhead funds. In order to minimize the impact on the clients' budgets, a portion of the ASD budget corresponding to the value of the services being provided was transferred to the client in order for them to purchase back those services. In the second year, all services (maintenance, support, and development) would be billed to the clients. During the budget preparation process for that second year, ASD would negotiate with each client a level of services to be provided that second year. The client would then include in its budget submission the funds necessary to contract with ASD to purchase the services, and ASD would include the expected revenue

from each client in its budget. Thus, the ASD budget would show 100% cost recovery for the year. In both phases, written service level agreements between ASD and each client were negotiated and signed so as to clearly identify the roles and responsibilities of both parties (these agreements are described in more detail on page seven).

No matter what revenue goal is established, it is important that the goal be clearly defined *and* communicated to clients, the staff of the development group, and senior management of the university. As with any other organizational or cultural change, there are a number of concerns that are raised by various parties that need to be addressed. Clients, for example, may be concerned about their need to estimate and justify the *explicit* expenditure of budgeted funds on applications development. Staff will be anxious about the need for cost accounting and their future job prospects as the group begins to compete with other service providers. The best way to alleviate these concerns is to inform all parties of the changes that are to be made and how those changes will affect them or their organizations. Discussions with both staff groups and client groups, where they have an opportunity to ask questions and make suggestions, can be a critical success factor in the process.

Marketing and Promotion

Once the organization's cost recovery goals are established, the focus must be shifted to marketing and promoting the group's services. When the central development group enjoyed a monopoly on its services, and in an era when demand for its services was growing continually, it could sit back and wait for clients to come to it. In the competitive environment, however, it is necessary to promote the organization's services to both existing and new clients. Remember that these clients have a wealth of alternatives to the central group's services: outside consultants, student programmers, software packages, and local experts. The central development group must inform its clients why the hiring of experienced and professional developers in-house can be to their advantage.

The first step is to identify and define the services that you are offering. *Applications development and maintenance* can be thought of as one or more of the following discrete services:

- Business Analysis
- Project Management
- Technical Writing
- Systems Analysis
- Programming
- Training
- Systems Design
- Testing
- Production Support

Many more types of services could certainly be added to this list. The central development group must decide which services it is providing, how the services are defined, and what mix of these services it is aiming for. For example, developing a new business application for a client may entail all of these services, from business analysis through to production support. This has been the traditional market served by the central development group. In the competitive environment, however, some clients may choose to purchase only certain services. A client that has its own programmers on its staff may purchase technical writing support, rather than hiring its own technical writers. Similarly, the central group may perform a business analysis and design a new system for a client who may have its own programmers perform the coding.

The next step is to assign a price to each of the services. Services can be priced on an hourly, daily, weekly, monthly, or annual basis, or can be based on fixed price quotations for each project. Two main factors determine the pricing of services: 1) cost recovery goals, and 2) market considerations. The cost recovery goals will determine the total revenue to be raised. If, for example, the goal is to recover 100% of the group's costs, then the services must be priced on a unit basis so that if 100% of the available units (hours, days, months) are billed out, the entire budget will be recovered. The availability and pricing of competing services in your geographic area will provide

information needed to determine the relative prices among the differing types of services to be offered. Figure 3 provides a detailed example of a pricing model similar to one used at MIT.

Example of a Pricing Model

Cost Recovery Goal: Recover 100% of budget ($2,000,000)

Staff Size: 1 Director, 1 Administrator, 3 Managers, 5 Project Leaders/Senior Analysts (PL), 20 Programmer/Analysts (PA), 3 Technical Writers (TW)

Market Assumptions: PLs are billed at 1.25 times the PA price; TWs are billed at .75 the PA price

Overhead Calculation: There are 52 forty-hour weeks in a year; from this, you have to subtract: 120 hours vacation, 96 hours of holidays, 80 hours of sick time, 80 hours of training/development, and 200 hours of miscellaneous overhead. Thus, a person who can be billed out can bill:
2,080 - 120 - 96 - 80 - 80 - 200 = 1,504 hours each year. Overhead rate = 28% (576 / 2,080).
Assume that Director, Administrator, and Managers are not billed out.

Pricing Formula: If P$ is the hourly cost of a Programmer/Analyst, then:
$2,000,000 = (1,504 x 5 PL x 1.25 x P$) + (1,504 x 20 PA x 1.00 x P$) + (1,504 x 3 TW x 0.75 x P$)
= (9,400 x P$) + (30,080 x P$) + (3,384 x P$)
= 42,864 x P$
therefore: P$ = $2,000,000 / 42,864 = $46.66
Programmer/Analysts: $46.66 x 1.00 = $46.66/hour
Project Leaders/Senior Analysts: $46.66 x 1.25 = $58.33/hour
Technical Writers: $46.66 x 0.75 = $35.00/hour

Figure 3

An important factor to keep in mind is the group's overhead rate. *Overhead* is used here to mean time spent on "non-billable" efforts, i.e., time spent not working directly on a project for a client. This includes categories like vacation, internal staff meetings, professional development, and marketing. In the model in Figure 3, which is fairly typical of many central development groups in universities, each staff member bills only 29 hours (40 x 72%) in an average work week. An organization that has not bothered to take its overhead activities into account, or has calculated the rate inaccurately, will find it difficult to meet revenue goals as well as project deadlines.

One overhead item that many organizations underestimate is that of the skills and professional development requirements of the staff and managers. In the pricing example above, 80 hours, or two weeks each year, were reserved for training and development. The experience at MIT has been that this is a fairly conservative estimate, and depending upon the mix of projects and existing skill level of your staff, the number will vary. An organization that has traditionally worked on mainframe computers using third generation languages will find that it will take much work to upgrade its staff's skills to take advantage of such technologies as relational databases, fourth generation languages, computer-aided software engineering (CASE) tools, and the like. It is also important to upgrade less technical skills such as project management and business analysis. This upgrading of skills is a requirement for positioning the group against competing providers who may specialize in certain service areas.

The actual marketing of the group's services is not a difficult task. Generally, the potential clients to whom you are marketing are a small group within the university — organizations like the

financial office, admissions office, and registrar. These are the clients with whom the central development group has been working for a number of years. Do not overlook, however, less traditional clients like academic department offices who have the need for business computing. The most important part of marketing the group's services is to be constantly aware of the business plans of your clients. By knowing what the short and long term plans of your clients are, you will be in a position to inform them as to how information systems can help them to achieve their goals.

In promoting the group's services to clients, you should emphasize the advantages of working with your group over working with outside consultants or establishing their own programming staffs. The following are typical advantages that the central development group often possesses:

- *Stability:* Your group will be there next year to support or enhance the system, while an outside consultant (or more importantly, part-time students) may be gone or not interested any longer.
- *Professionalism:* Emphasize the professionalism you bring to a project, your group's project management skills, knowledge of existing systems and their integration, and knowledge of the university. Remind the admissions director that managing data processing professionals is very different from managing admissions counselors.
- *Relationship with other branches of IS:* Capitalize on your group's ability to offer "full service computing" in concert with the data center and information center.

When you have learned of a project either through a conversation with administrators in client offices or in some less formal way, move quickly to set an appointment to learn more about the proposed work and to assess the potential for your group to bid on the project.

The following sections focus on how ASD delivers development services as they are propelled by a series of project management documents.

Selling and Customer Service

One way to approach the issue of selling and customer service is in terms of the documents that support those activities. In ASD, three documents move us from potential to actual work: *proposal, service level agreement (SLA),* and *project plan.*

If an organization follows a methodology closely, a formal proposal will be the first step in establishing a relationship with the customer. ASD's offices are in a building which also houses many of its long-term administrative clients, so that a great deal of the proposal activity is conducted in ad hoc meetings and conversation. For this reason, ASD often does not prepare a formal, written proposal.

A service level agreement is the second document in the correct sequence of business documents. An SLA's purpose "...is to create a common understanding about what services will be provided, what resources are available (i.e., both people and equipment), and what level of service users can expect, and what priorities will apply."[3] At MIT the term *service level agreement* means either a contract to work on a specific project, or a contract to provide one or more services at some level of effort for a period of time, often a fiscal year.

If the service level agreement is a contract for a specific project, ASD will draw up the project plan first, since some of the facts and figures in the SLA are drawn from information gathered for the

[3] Naomi Karten, Editor, "Establishing Service Level Agreements", Managing End-User Computing, November 1988, p. 1.

project plan. When there is a written proposal, much of the required information is already available.

When the contract provides services for a period of time, then projects and/or tasks will be defined within it, though they may not all be identified at the beginning of the term. In this case, as projects come into focus, ASD develops a project plan for each.

Each of these documents follows a standard format, and can be available as a template to the project leader or whoever is the author. To project the department's professionalism these documents should be carefully written and reviewed. In ASD the director reviews all of these documents before releasing them to the customer.

Proposal

The proposal is in part a *marketing document* throughout which the service provider conveys its special qualifications for being chosen to do the job. The proposal contains sections covering:

- A description or overview of the current situation
- Scope and approach of proposed services and/or
- A description of products (if any) to be developed
- A list of tasks and associated cost estimates
- Schedules for doing the work
- Names and qualifications of staff who will work on the project
- Assumptions about client participation and responsibilities, and availability of other resources
- Description of management control procedures

The project leader gathers information for the proposal through interviews with staff in the client office. Since a proposal is a standard document, it is just a matter of fitting the interview information, solutions, and schedules to the proposal template. Short biographies of staff may be kept on file to retrieve as attachments. Similarly, management control procedures, which will likely not vary significantly from project to project, can be adapted from some general description of them.

Service Level Agreement

The service level agreement is a *contract document* and comprises the following parts:

- A general statement naming the contracting departments
- The terms of the agreement (start and end dates)
- The kind of service to be performed (analysis, programming, technical writing)
- The development group's responsibilities
- The client's responsibilities
- Special conditions related to confidentiality, copyright, subcontractors, and vendors
- Method and rates of compensation

The project leader prepares a service level agreement using a template as a starting point and referring to existing SLAs as models. The director reviews the agreement before it is delivered to the client for approval and a signature. When the project leader and client agree on all the content, the client signs and returns the agreement for the director's signature.

Project Plan

The project plan is a *project management document*. It defines the project in full detail, drawing on information gathered for the proposal if one was written. It includes:

- An introduction that summarizes the scope of the project
- A list of related documents that have accumulated around the project
- A statement of work, including development tasks, documentation tasks, support tasks, training and education tasks, test plans, and when appropriate, plans for benchmarking vendor-supplied application software
- A description of how the project is organized, how information about project progress will be communicated, and of the development methodology and associated tools
- Names, titles, and full-time equivalent levels of all staff assigned to the project including client staff with roles and responsibilities for each
- Hardware and software resources
- Schedules — a schedule of phases, and a detailed schedule of tasks
- Development standards for programming, documentation, testing, and audit/control

The project leader also prepares the project plan and submits it to the director for his approval. Client sign-off is required on the project plan, as it is important as a communication medium to clarify all aspects of the project. The client representative (generally the person who authorizes the contract) receives a draft version to review and comment before ASD publishes the final plan for his approval.

Managing the Project in the Competitive Environment

Once the project is underway, it is essential to stay in contact with the client as work progresses, providing periodic updates on project progress, hours spent, and costs. Close tracking will provide plenty of warning if the project begins to wander off course either in focus or hours spent. The need for good project management techniques is not unique to the competitive environment, but it takes on additional importance in determining the group's success.

Accounting for Project Efforts and Costs

One of the first controls that ASD adopted in its move towards cost recovery was the weekly *Time Accounting Form*. The Time Accounting Form is divided into two sections. The top grid is designed to capture the hours a staff person has spent by project and by activity within each project (analysis, design, programming, testing, implementation, production support, documentation). The lower grid collects hours spent on overhead activities such as professional development, vacation, or general support.

Every week, ASD staff members fill out a form accounting for hours spent in the previous week. The data are entered into a database system from which are generated monthly reports in various formats. A Project Effort Report for a client shows hours worked for the month by staff member and by activity, the total value of the effort, and the billable amounts. ASD managers receive another version of the same report, but formatted differently, and including all ASD projects. Figure 4 on the next page shows a sample of the report that is sent to the client.

Clients are billed monthly for ASD services. A separate general ledger transaction (journal voucher transfer) is prepared, and a copy sent to the client with the monthly Project Effort Report.

M.I.T. Administrative Systems Development
Project Effort Report

Project Name: *Undergraduate Admissions System Support*
Department: *Admissions Office*
Client Contact: *John Betteec:n, 3-108*
ASD Project Leader: *Wanda Meredith, E19-439, X1507*
Report Period: *October, 198[illegible]*

Employee Name	Hourly Billing Rate	Services (number of hours): Analysis	Design	Programming	Testing	Production Support	Documentation	Project Management & Other Tasks	Total Hours	Total Value of Services	*	Total Billable Services
Lou G. Bernard	$38						34.5		34.5	$1,311	Y	$1,311
Strom Lawrence	$52			38.0	27.5	27.0			90.5	$4,706	Y	$4,708
Strom Lawrence	$38						9.0		9.0	$342	Y	$342
Wanda Meredith	$59	5.0	2.5			1.0		12.5	21.0	$1,239	Y	$1,239
Flannery Peters	$52	1.5							1.5	$78	Y	$78
Conrad Victoria	$52			8.0					8.0	$418	Y	$416
	Totals:	6.5	2.5	44.0	27.5	28.0	43.5	12.5	16:.5	$8,092		$8,092
									Mainframe Computer Charges:	$1,845		
									Total:	$9,937		$8,092

Total equivalent full time (EFT) effort on this project during the period: 1.18

Account Number:	17688
Object Code:	421

This report details for you the number of hours worked and the total value (at prevailing ASD billing rates) of the services we have performed on this project during the period shown above. Also shown is the total cost of the mainframe computer charges (if any) that were incurred by ASD in support of this project. If you have any questions about this information, please contact the ASD Project Leader shown above. This report is for your information only, and no action is required on your part.

* ***Note:*** A "Y" in this column indicates that the services on that line are billable to you under the terms of the Service Level Agreement that governs our efforts on this project. If there were any billable charges on this project, a journal voucher for the total billable charges has been forwarded to the CAO (copy attached).

Figure 4

Reporting Project Progress

In addition to the Project Effort report which is generated and distributed from headquarters, the project leader is also responsible for preparing a periodic project status report according to whatever has been agreed to in the project plan. While there are no standards yet in place for this report, the memo format is convenient. Report content is fairly standard and should provide a list of tasks accomplished with hours spent; a list of tasks planned for the next reporting period with hours estimated; and number of hours remaining under the contract. Also included is a comments section in which the project leader reports any problems, delays, or general information.

Maintaining and Modifying the Contract

No amount of careful planning and estimating will ever ensure that a project will run from start to finish without changes, either because the client wants something more or different, or because of some snag that the technical staff encounter. Changes, of course, must be thoroughly defined and incorporated into development plans and project management paperwork. ASD has done this either with an addendum to the SLA or with a Change Request Form.

The addendum method simply rewrites the sections of the SLA that the change affects. For example, the duration of the project might be extended, thus changing the terms. Or a new activity such

as documentation might be added requiring changes to provision of work, ASD responsibilities, and compensation. The addendum is more suitable to high level and administrative changes, and therefore requires the signature of the ASD Director and the highest level client involved in the project.

The Change Request Form is less complicated to prepare and is suited to documenting new or changed tasks. The form names and describes the task, and gives new time and cost estimates. A change at this level may also impact work that has already been done, so there is space to account for other parts of the system that may be affected. This form must be signed by both the project leader and the client representative.

Completing the Project

Closing out a project can be one of the greatest challenges facing a project leader. Ultimately the end must be declared when the contract has been fulfilled and the system is working, even if either customer or ASD staff long to add just one more feature or change one more thing.

The system can be signed off in stages using a *Task Acceptance Form* that is oriented to tasks rather than phases or whole systems. In addition to providing all the identifying information about the task (system name, project name, client and ASD names, and finally task name) the form provides space for ASD comments to the client. The client has the option to accept the work as done, to accept the task as done but with conditions, or not to accept the task. If the task is accepted only conditionally or not at all, then the client is expected to explain the conditions or objections in the space provided. Thus, each task is finished and signed off by the customer until the last task is signed off and the project is complete.

As for the additional features and enhancements that surfaced in the course of development, these may be viewed as new work to be renegotiated under a new service level agreement, or defined as a new project.

Summary

At MIT we found there were a number of factors that were critical to our achievements to date, and that will continue to influence our success in the future. While every university is different, we believe that a number of these can be applied to many other organizations who find themselves in a position similar to ours:

- Clearly define your organizational cost recovery goals, and communicate them clearly to staff, clients, and senior management of the university.
- Clearly define and communicate the array of services to be offered.
- Identify overhead rates and incorporate them into project estimates and schedules.
- Establish credibility and recognition as a business unit that is interested in competing with other service providers, rather than simply enjoying a monopoly position.
- Plan and manage projects effectively and consistently across the organization.
- Maintain and upgrade staff skill levels, both technical and managerial, to make use of new technologies.

THE COST OF NOT STAYING CURRENT

PRESENTED BY:
JACK T. TINSLEY
BETTY R. NEYER

FLORIDA COMMUNITY COLLEGE

CAUSE 1988 CONFERENCE

INTRODUCTION

Florida Community College at Jacksonville began operation in August 1966 with an enrollment of 2,610. Today the College enrolls more than 72,000 students annually. The College offers the associate in arts (A.A) degree, associate in science (A.S.) degree, adult basic education leading to the the high school diploma or the GED diploma, certificate programs and self-enrichment courses.

OVERVIEW OF CHANGES

A brief overview of the changes that have occurred over the past two and a half (2 1/2) years is presented to provide a point of reference of what was needed for the College to "catch-up" with technology.

STUDENT SUCCESS

New programs in microcomputer specialist and word processing specialist for disabled students and displaced homemakers have been added.

Lab facilities have tripled in size.

Computer science courses,which previously were taught on a Prime computer, are taught on the IBM 4381 computer.

AutoCad offerings have been expanded to include mechanical engineering and landscaping architecture.

Students enrolled in the travel agency program are gaining experience in using computers to make airline, hotel and motel reservations.

Students in the medical assisting program are using computers to learn medical office management.

ENHANCED COMMUNICATIONS

Electronic mail is used throughout the college by over 600 (or 60%) full-time employees.

Almost 500 microcomputers and terminals are linked to the mainframe with an average of 300 signed on simultaneously at any one time.

Documents may be transferred from one microcomputer to another through the host computer system.

Job vacancies, job descriptions, college catalog, course descriptions and outlines, phone book, and administrative

procedures are updated and available on the network.

Touchtone telephone registration has been installed and is used by more than 10,000 credit students (67% of all credit students) each term.

A new financial system is being installed which will replace a 19 year old package. It will also automate the purchasing function which heretofore has not been automated.

VALUED EMPLOYEES

450 new microcomputers have been installed throughout the college.

Faculty are using technology to manage their gradebook.

Scanners for grading and scoring tests are available for one of every 10 faculty (these scanners also communicate with the gradebook software).

A Support Center is available at each campus for use by faculty, students, and staff in generating laser-quality hard copy, color transparencies or overhead slides from microcomputer generated data.

INNOVATION FOR EXCELLENCE

A new graphics arts course utilizing computer graphics software has been added to the curriculum.

A new course in desktop publishing (and two desktop publishing labs) have been added.

A new program in information systems specialist is being added.

Transcripts may be transferred electronically to any other Florida educational institution.

Faculty and staff are using desktop publishing software to produce filers, bulletins, newsletters, and presentation materials at their desk.

An on-line room scheduling system has been written which will significantly impact the scheduling of over 1,000 meetings for external community groups.

IMPACT ON THE MAINFRAME ENVIRONMENT

To accommodate actual and planned growth, significant enhancements have been made to the mainframe environment.

Over 20 miles of cable has been laid.

The processing power of the mainframe has increased 66%. All old terminals were replaced in order to take advantage of newer technology.

The amount of data that may be stored on tapes has quadrupled and processing speed of the drives has been doubled.

Disk storage capacity has more than tripled.

Operating systems have been upgraded.

Data communication rates have doubled and the number of data communication line increased from 5 to 15.

IMPLEMENTATION ACTIVITIES

In order to move the college ahead, several activities needed to be accomplished.

First, additional staff and organizational changes had to be made to ensure the success of the technological advancements.

Second, a planning process and a plan were needed to determine the direction for technological advancements at the College.

Third, hardware and software standards needed to be identified to meet the needs identified through the planning process.

Fourth, hardware and software needed to be purchased and installed.

Fifth, a program was needed to train faculty and Information Systems and Services staff to ensure technology was incorporated quickly and effectively.

Finally, hardware and software needed to be maintained and upgraded in order to keep up with changing technology.

ORGANIZATION

In order to move the College ahead quickly, several organizational changes were made. A technical support person was added to ensure new equipment and enhancements were implemented smoothly and effectively. Applications programming staff have been added to update existing systems and install new systems. A new department, Information

Resources Planning and User Services, was added to coordinate planning and procurement, and provide training, maintenance, installation, and consultation to end users.(A copy of the organizational chart is included in Appendix A.)

ORGANIZATIONAL ISSUES

Who will handle maintenance? Will maintenance be done in-house or through an outside vendor? Will maintenance be handled centrally?

Will academic and administrative computing be combined? What will the relationship be between academic and administrative computing?

Who will handle hardware and software installation? How will software be upgraded when a new release is available?

Will a training program be needed?

How will the College replace its trained workforce? We are facing the problem that when a loyal, long term employee leaves, the College is having difficulty finding a replacement with a similar skill level in the use of technology.

How will planning be accomplished?

What committees will be needed?

PLANNING

Almost three years ago, Information Systems and Services was charged by our President to "bring the College up-to-date technologically."

To accomplish this assignment, an assessment was made of where the College was. Concurrently with this assessment it was also vital to assess the future directions for technology at the College.

This first year, over one-half of the College employees were interviewed in small groups. A bottom-up planning process was utilized. Staff, then department chairs followed by assistant deans and deans were interviewed with each level setting priorities for areas reporting to them.

Based on the interviews and priorities set by interviewed staff, a three-year plan was developed with the major objectives of:

1. Fostering the transfer of technology into the classroom;
2. Utilizing technology to enhance communications;
3. Increasing access to College information;
4. Supporting the automation of offices; and
5. Ensuring optimal operation of mainframe resources.

The Information Resource Plan was reviewed and approved by the Information Systems Council, consisting of vice presidents, the Associate Vice President of Information Systems and Services, and representatives of instructional and non-instructional staff.

PLANNING ISSUES

Commitment from the top: Success is directly related to commitment of the president.

Top-down or bottom-up approach: The bottom-up interview approach has been beneficial to Information Systems and Services staff in developing an understanding of College operations and enhancing credibility. This approach has also fostered a proactive rather than a reactive posture in implementation. As the College community becomes more technologically sophisticated, the planning is becoming more reactive.

Level of involvement of college community: As each year passes, the planning process becomes more formalized and structured. We have moved from one planning group (Information Systems Council) to two planning groups, one for instruction and one for non-instruction.

Although there are two planning groups, the final product is combined into a single plan.

Interface with other planning processes: Initially, the Information Systems Plan was developed separately from the College Strategic Plan. Data collection is now performed through the same process but the development and approval of the plan remains separate. Each year, at the beginning of the College's planning process, funds are set aside for the cost to continue, strategic plan and information resources.

Funding, centralized or decentralized: Centralization of funding enables the College to monitor computer-related expenditures as well as maintain continuity with the Information Systems Plan. In addition, centralization enables the Information Systems and Services staff to ensure support resources (e.g.,training, installation, and consultation) are available to assist in the successful implementation of funded activities.

Level and source of funding: The College has committed an additional $800,000 to 1,000,000 in new funds each year (almost 2% of the College's total operating budget). Now that the College is beginning to "catch up" and is in a better position to compete for funds, more funds are becoming available through the Foundation and grants.

HARDWARE AND SOFTWARE STANDARDS

Development of standards provides significant opportunities to save money (through volume purchases), reduces the time spent in ensuring software and hardware works together, reduces maintenance and trouble-shooting costs, and expedites the introduction of technology.

HARDWARE AND SOFTWARE STANDARDIZATION ISSUES

1. Compatibility with mainframe directions;
2. Connectivity to the mainframe and to each other;
3. Transportability of software from one package to another;
4. Ability of software or hardware to function with existing standards; and
5. Maintainability in terms of training, upgrading, repairing, redistributing, and trouble-shooting.

For office automation, the standards are:

IBM Microcomputers with Color Monitor and Graphics
Word Processing (Displaywrite 4)
Spreadsheets (VP Planner)
Database (Q&A)
Graphics (Harvard Graphics and Freelance Plus)
Desktop Publishing (First Publisher and Pagemaker)
Communications (Crosstalk)
Emulation (3270 Emulation Program)
Terminals (Telex and IBM)
Gradebook Management (Parscore)
Menu System (Fixed Disk Organizer)
Backup Utility (Intelligent Backup)
Network (Novelle)

For instruction, no software standard apply across all labs. Within a single teaching lab, the same hardware and software configuration is maintained (i.e. same software, same keyboard, same hard disk size, same display, and the same printer type).

ACQUISITION AND INSTALLATION

All computer and related purchases are submitted through the Information Systems and Services Department. Equipment installations as well as software installations are handled by the department.

ACQUISITIONS AND INSTALLATION ISSUES

Centralized versus decentralized acquisition: Centralized acquisition provides the College an opportunity to realize considerable monetary savings. In addition, centralization ensured that all the right features (such as adapters and cables) as well as necessary software and furniture are ordered. As new equipment is purchased and "old" users outgrow their machines, new equipment may be assigned to an "old" user and displaced equipment redistributed to the new user.

Centralized versus decentralized installation: All microcomputers in labs and offices have a standard configuration. A faculty or other employee may move from one machine to another and be able to operate the equipment easily. Since all machines are configured similarly many user problems may be handled over the telephone instead of through an on-site visit.

Equipment storage: Since installation is a centralized function at the College, sometimes it is necessary to store equipment. To reduce the time spent on installations, workstations are not installed until all parts have been received. Many workstations have parts ordered from as many as five vendors which, at times, causes significant delays in the arrival of all components.

Extra equipment and parts: The College carries extra parts (keyboards, software, adapters, and cables) so that equipment repairs may be handled quickly. Extra printers are also carried in stock.

TRAINING

Personnel must be trained in the use of technology to make effective use of resources. This applies to the end users of technology as well as to the staff who support them.

TRAINING ISSUES

Training information systems staff: For the most part, programming, technical support and operations staff are trained on-site by bringing in external trainers or by attending local seminars. For microcomputer training, one

individual is sent to a training school and then returns to train the staff and the faculty of the College.

Training format: When is it preferable to provide one-to-one tutoring versus classroom training versus self study? Will motivators (college credit, monetary rewards) be used to encourage staff to receive training? What are other training methods (newsletters, user groups)? Under what circumstances will employees attend outside (more costly?) seminars?

Training new employees quickly: How can new employees be trained quickly to support continuity within departments?

Training as a requisite for hardware and software: Should training be a prerequisite to the receipt of hardware and software?

Supervisory support of training: Are supervisors committed to their staff being trained? Are supervisors aware of their responsibilities in maintaining reliable systems?

HARDWARE AND SOFTWARE MAINTENANCE

The cost of maintaining (or not maintaining) hardware and software is high. Maintenance involves not only keeping equipment operational, but handling user problems and upgrading users who have outgrown (or need new functionality from) their equipment. The College has approximately one full-time person per 125 workstations to handle maintenance. An outside vendor serves as backup for hardware problems. Approximately 90% of user calls are not caused by hardware malfunction. With outside vendors, we spend approximately $20,000 per year to maintain over 600 microcomputers, 400 printers, scanners, lasers. and other miscellaneous peripheral devices. A newsletter is published bimonthly which keeps users informed of available software upgrades and answers to questions frequently asked of the staff.

HARDWARE AND SOFTWARE MAINTENANCE ISSUES

What maintenance will be handled inside and outside?

Will maintenance be charged to a centralized account or charged to individual departments?

Will maintenance for labs and offices be handled the same?

How can problems other than those related to equipment malfunction be reduced?

How can maintenance be handled efficiently and effectively? Evaluate the cost for on-site warranties.

How can the cost for maintenance be contained?

SUMMARY STATEMENT

The intent of this paper has been to describe how one institution has dealt with trying to "catch-up" with technology and to identify some of the issues that surface during such a process. Additional issues have also been presented for the reader to consider.

Project Management in Higher Education
Making It Fit the Due Date

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Abstract: We all manage projects. Every day we are called on to possess the skills of a project planner. Typical questions we receive are: "How long will it take?"; "Who will be available to do this?"; "What will it cost to do this?"; "When will it be done?". If you have answered questions like this, then you're a project manager! How you answer questions quite like these may have a severe impact on your institution. What will be scheduled or cost justified based on your answer? Can you approach these issues in a systematic way that will yield a high probability of accuracy? This session will address the answers to these questions by first examining some of the underlying principles of classical project management. Then give some insight into the current state of data processing project management. Finally, an abbreviated methodology will be given for the fast track approach to project management.

Welcome to Project Management in Higher Education, better known as "Making it fit the due date." Today we will review some underlying principles of classical project management. Then we will delve into the current state of data processing project management with a brief review of an implementation project. Then we will conclude with an abbreviated methodology that I call the "fast track" approach to project management.

What is a project? We all manage projects. Every day we are called on to possess the skills of a project planner whether it be the publication of a departmental report or the completion of an expensive development project. In a nutshell a project is a collection of tasks which consumes resources leading to the completion of an objective. So the project must have a measurable objective and consume resources. What is an example of a measurable objective? In the early 60's, the late president John F. Kennedy called for a project to land a man on the moon by the end of the decade and - this is the part that the astronauts liked best - return him safely to earth. Is this measurable? You bet. There is a time limit and a task objective. On January 1, 1970 would you be able to measure the result of the project? Absolutely. This is a good example of a measurable project objective.

What is a task. We have seen that a project is a collection of tasks: but how is a task different from a project? Surprisingly, a task in one project may be a project to the resource assigned to complete it. But in general a task is more detailed than a project. It also must have a measurable objective and consume resources. The resources may be time, dollars and/or people. If a task consumes no resources, why would you do it? How would you measure it? Never list a task that has no outcome.

What is a dependency? A dependency is relationship between two or more tasks. There are many relationships that are used. The most popular is the finish to start. This means that you must finish the first task before the second task may start. For instance, I can't fill a foundation hole with concrete until the foundation has been dug. In data processing this is rarely as concrete as ... concrete. Don't you sometimes start coding before the design is done? This, if it is planned, could be a lead or a lag relationship which is really nothing more than an overlap of tasks. Start to start means that one task can not start before another task has started. It does not mean that both tasks must start at the same instant. Finish to finish you can explain if you understand start to start. As the professor would say, "do that as an exercise tonight." Date determined relationships are driven by a milestone. For example, the arrival of a bulldozer on August 1, 1989 will be the trigger for the bulldozer operator to begin clearing the land. The arrival of the new database package will be the trigger for the systems programmer to begin installing the new product. Resource constrained dependencies are usually not predefined but rather occur, when for instance the systems programmer is at a CAUSE conference.

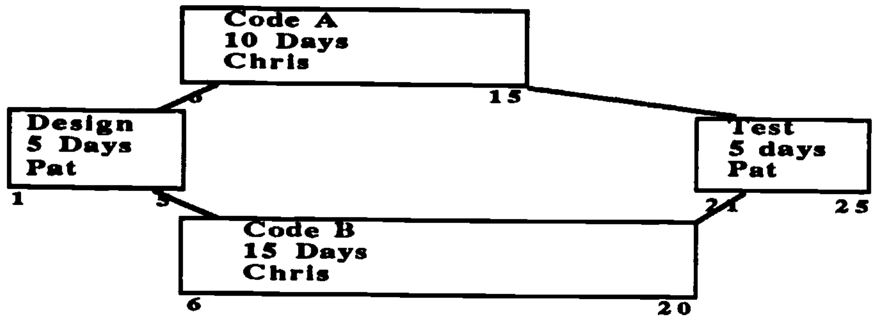
After defining your project and its tasks and relationships you will calculate the critical path. What is the critical path? The critical path is the sequence of tasks from the beginning of the project to the end of the project which has the longest duration of time to complete. That sounds hard but is actually quite easy with the computerized tools that are available. The hard part is that the definition should end with "at this time." The critical path will change as progress or the lack of progress is reported.

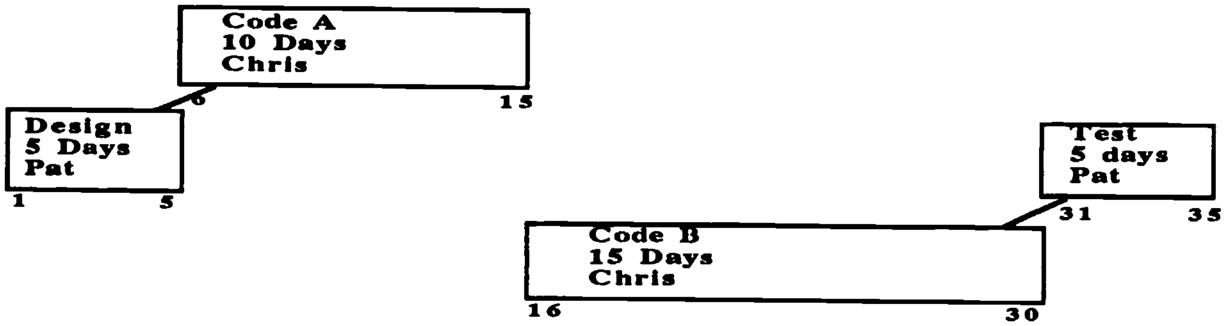
Let's now take a look at how a software project would evolve. If I am given a

project to create a program, the first thing I have to do is define the project objective. This is sometimes wrongly called the requirements definition. I need a more global but measurable objective. For instance I am to create a program that will read a text file and print it to the laser printer within 25 days using my 1 systems analyst and my 1 programmer. I determine the steps to be a design step, coding of the file read is module A and coding of the print is module B. The modules will be unit tested as part of the coding task. A systems test will be done when the two modules are completed.

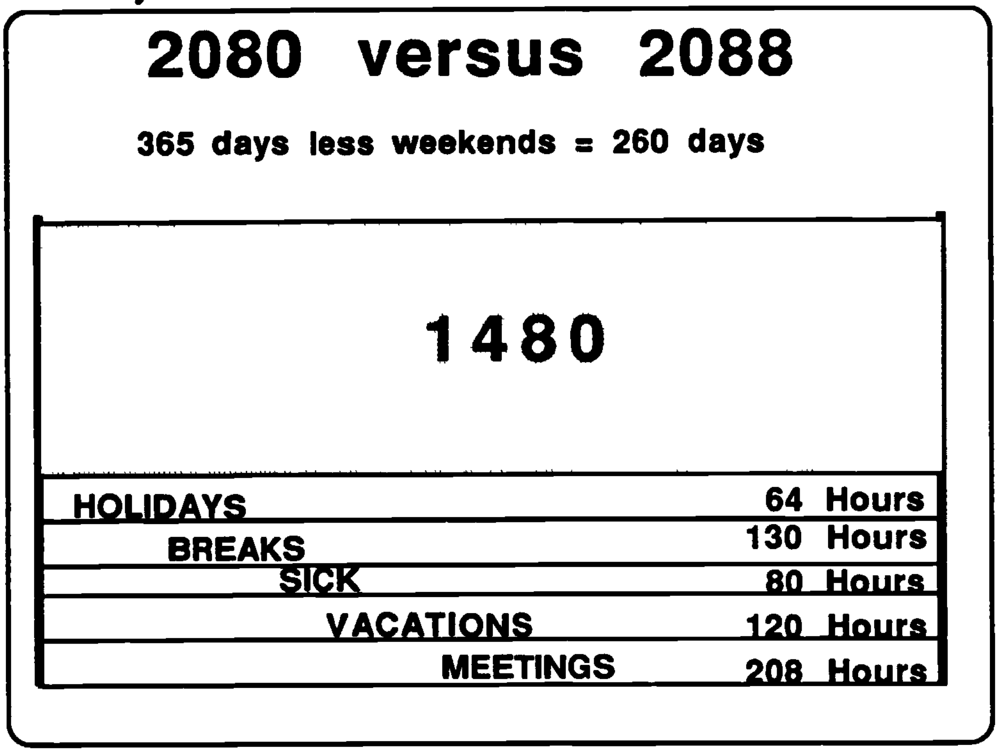
After listing the tasks I will now estimate the time. Design should take 5 days. The coding of module A might take 10 days and module B's coding might take 15 days. I will allow 5 days to test the system. It looks like the whole project will take ...... 15 days. What's that? You don't think you can code before the design is done? Really? How many of us have done just that? Okay, you're right. We do need to define some dependencies or relationships. Let's use finish to start relationships such that the coding can't start until the design is done and system testing can't happen until the coding is done. Now how long will the project take?
To be sure, we must learn to calculate the critical path. We start with Design which begins on project day 1 and is scheduled to last until day 5. Then Code A may begin on day 6 and run until day 15. Code B will also start on day 6 and run until day 20. Test may start after both of the relationships known as predecessors have completed. Test may begin on day 21 and run until day 25. Right on target with our objective.

Now it's time to add resources to the tasks. Remember that I have 1 analyst and 1 programmer. Pat is my analyst and will do the design and system testing. Chris is my programmer and will perform all of the coding. Now the project looks like this. Well.... does it? We know Design will start on day 1 and run until day 5, then Code A will start on day 6 and run until day 15. But Code B can't start on day 6 since Chris is working full time on Code A. What happens now? In the real world, if I can't get another programmer then Code B will start on day 16 and finish on day 30!





Testing will begin on day 31 and finish on day 35. That's 10 days over schedule! If you aren't planning this way or making certain that your project planners are planning this way you're in trouble. Anything else you should worry about? How about meetings, vacations, sick time, snow days and all of the other various distractions that often account for project overruns. Have you seen the mythical year of 2080 (2088 during leap year) hours. When you start subtracting your holidays etc. you may find that 1480 hours (1488 during leap year) are all that are left. What I am saying to you is to allow a block out of 30% of your resources time. This will make your estimates more accurate.



Now that we have a plan we need a way to tell if our project is a success. At the end of the time we must first evaluate whether we met the objective. Does the program read a file and write it to the laser printer accurately? After that criteria is met we can evaluate our performance. Were we on time? In our example, if our resources met our estimates we are on time. But we are 10 days over schedule. We are probably on budget but if we had had to rent equipment and keep it for 10 extra days we may be overbudget. From a human resource benefits standpoint, we may have allocated 10 additional days per resource to the project and could be overbudget because of that overhead. Any of these things could have happened even though my resources finished their tasks in the amount of time estimated and budgeted.

I'd like to introduce Bob DeBruin of Central Michigan University to share some stories with you about a real live project. Bob... (See three pages immediately following)

Thanks Bob that certainly helps put things into perspective.

I'd like to focus in now on methods we can use to help make the project fit the budget. Do we think that the Data Processing field is any different from Construction with regards to project management? Actually the difference is in the

tools that are available not in the techniques that are used to plan and schedule. First of all we have several fine methodologies available that tell us 1) what to do, 2) when to do it, 3) how to do it and 4) why you do it. Most methodologies fall into one of two categories: the so called standard methodologies which are characterized as third generation techniques and structured methodologies that are capable of handling fourth generation technology and techniques such as CASE (Computer Aided Systems Engineering) tools.

What the standard methodologies bring us first, of course, are standards. These help us maintain consistency across large project teams so that integration and maintenance will be less costly in the future and enable us to share and reuse code during development. The standard methods lead us from interviewing the user to arrive at a requirements definition through the post implementation review and measurement of project success. They unfortunately also brought us paperwork by the ton. The newer structured methodologies brought us better standards able to take advantage of the automated tools for dataflow diagramming and entity relationship drawing that enables us to save time on coding both at development time and at maintenance time. The structured methods give us the capability to "prove" the correctness of our code before coding begins. They also brought us structured paperwork. This leads me to some advice. When you adopt a methodology it is not necessary to use every form and technique in the book. Part of implementing the methodology is to select those parts that are appropriate for new development projects, maintenance projects or small projects. Remember, methodologies give us the steps we need to do, guidance on estimating time, reminder of dependency relationships and guidance on the skills and knowledge necessary for a resource to perform a task.

Speaking of estimating, there are several very strong tools that assist you in estimating task time. They all generally come down to one of two methods. The empirical method is direct observation. I saw this coding performed on a similar project and it took 10 days. Sometimes this is called "seat of the pants" or guesstimating. The other is the implicit method which stretches the duration of tasks based on the number of influencing variables. For instance, you would break the task of interviewing down into manageable parts such as how many interviews, how long to write each report and how long to summarize the findings. By breaking each task into its component parts you are able to deal with estimates of things that are more easily grasped by your mind.

The net outcome of these estimating techniques and methodologies is something like this. For a standard methodology the four major development phases are the requirements definition, specification, design and coding. Coding will take up to 50% of the time allocated. With a structured methodology the coding time may be as little as 3%! This is because the structured techniques force you to design to a greater level of detail thus saving ambiguity later.

Finally, we should look at project tracking and monitoring. I called this the missing piece. There are three types of tracking. Time tracking which is measuring the time spent by a resource on the performance of a task. You better be also getting an estimate of time remaining not a subtraction of time spent from time budgeted. Deliverable tracking is a method of breaking all tasks into chunks of 8 to 80 hours so that you may see the delivered product at the end of each task. Milestone tracking is

a more global method but is the same idea as system testing compared to unit testing. Milestone tracking measures the movement of the group toward the objective. All three methods should be used on each project.

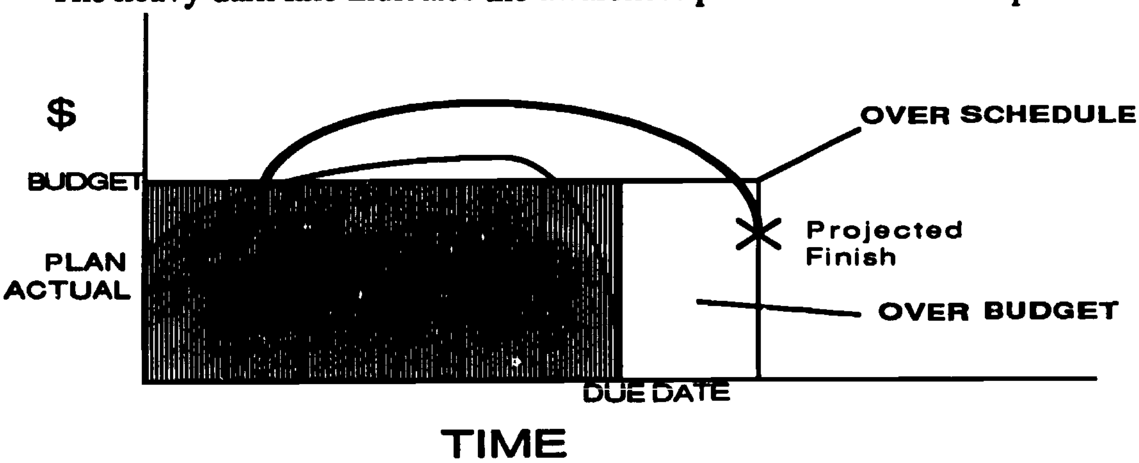
The carrot/stick question is frequently asked. When you track someone you must monitor their performance. Sometimes their performance will fall short of your expectations. When do you use the reward and when do you use the punishment? That is a question that every manager must decide at each step of monitoring. I wish there was a hard and fast rule but the best decision maker is the manager who is closest to the task.

Now that we understand the scheduling part of project management, we may turn our attention to cost monitoring by looking at a typical life cycle of a project. We will eventually build up to comparing budget vs. plan vs actual by time by schedule by budget. Isn't that how you evaluate projects in Finance?

Step 1 of the Life Cycle takes the budget and evenly distributes it over time up to the due date. In our sample project that we looked at earlier we evenly distributed our budget over 25 days. This is dollars on the left axis and time on the bottom axis. Step 2 we create a project plan and see that the "actual" consumption of resources will not be a straight line. In our example we had only Pat working the first five days then had Chris working double time in the middle and finally dropped back down to only Pat working on system testing. This does not represent a major deviation but it does have some cash flow implications in the middle.

Step 3 of the project life cycle could be called the discovery phase. Here we learn that Pat didn't work 100% on the project. Early on it looked like we were beating the budget for this project. Then we learned that Pat was being used for other short tasks, going to meetings and writing reports. To compensate we would normally steal time from other projects to help Pat. We also would suddenly realize that Chris couldn't do two 100% tasks at once and would have to have other help assigned. Now we also begin to run into the mythical 2080 hour year and find that the design and coding tasks are running over schedule. There is a fact of life that we run into here. Some tasks can not be improved by adding resources. In Data processing you'll hear the idea that if one programmer can do a task in 5 days how long will it take with two programmers? The answer is 10 days because they'll argue about how to do it and each do it their own way. A corollary to this is the idea that if it takes the Queen Elizabeth 9 days to cross the Atlantic how long will it take 9 Queen Elizabeths to cross the same ocean?

The heavy dark line indicates the awareness phase of time consumption.



At this point we finally reschedule the project. We now find that the project will cost more and take longer than we expected. The only way to make the project fit the due date and budget now is what? We must reduce the functionality. Instead of reading the file and writing it to the laser printer - now we will only read the file. If this is unacceptable then you need the additional time and the additional dollars. How do you make the project fit the due date? You have to do it during the early planning and on going management of the project. What have we learned?

There is a practical approach to project management. Here is what I call the Fast Track Approach.

1. Identify the tasks that are required. Use a methodology if you can.

2. Define the relationships between tasks. Do this realistically. If a relationship exists indicate it but do not create relationships that do not exist.

3. Estimate the effort required. Use a methodology. Use empirical or implicit methods but be honest and allow for resource down time. Under no circumstances allow yourself to be badgered into reducing an estimate. And never, ever when asked "How long will it take?" say "when do you want it". Say "Let me evaluate the project. What priority does this have? Is it more important or less important than the project I am currently working on?"

4. Schedule the project. Do a critical path schedule using one of the numerous fine scheduling systems that are available. Look at the critical path does it make sense or did you make a logic error?

5. Assign resources. If you don't know who will be available do it generically as programmer 1, analyst 1, etc. Look at the results. Can you do with one less resource? Do you need one more?

6. Reschedule the project. Yes, reschedule! Remember the critical path can change.

7. Evaluate costs. Now apply the resource rates and equipment costs to the project and look at the results. Only now are you able to correctly project a budget.

8. Reschedule the project. See how the cash flow is effected by using real rates for the project. Prepare your financial people for the cash flow.

9. Track progress. Ask questions. Check on the progress. Remember that tasks progress rapidly until they are 90% complete then it takes an equal amount of time to complete the last 10%. Are the deliverables on time? Are we meeting the milestones? Do you really think you will make up the time between the milestones?

10. Reschedule the project. You did remember to ask for new estimates of time remaining when you updated the progress didn't you?

11. Monitor completion of the objectives. Does the project do what we intended it to do?

Now you can relax. You have done your best job of managing the project. Your rewards will be many. You will be rewarded with more projects to manage. Good luck.

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During the mid-1980's Central Michigan University (CMU) was evaluating what we believed our computer hardware and software needs to be for the 1990's and beyond. We had two hardware systems - one academic and one administrative - some purchased administrative software and some developed in-house, particularly our student data system. A decision was made to replace all our administrative software and to replace hardware, if needed. In late 1986 and early 1987, we chose to go with:

* an IBM 3090 mainframe for all administrative computing and for all academic computing except for Computer Science
* a VAX system for Computer Science
* a SCT Symmetry administrative systems software, using CINCOM's SUPRA database

Our project was to implement four major SCT systems:

financial system - IFIS
human resources system, with both personnel and payroll functions- HRIS
student system - ISIS
alumni and donor development system - ADD

with due dates as follows:

IFIS on July 1, 1988 (one year after installing the IBM hardware and the SCT software)
HRIS on January 1, 1989
ISIS on September 1, 1988 for admission of students who would begin attending Summer or Fall 1989, and on March 1989 for the first registration of students attending Summer 1989 classes
ADD, no date was established, but it was to follow ISIS

In addition to these SCT systems, the University began implementation of the NOTIS library system during the Fall 1988 semester.

As you can see, this schedule was a very aggressive one - designed so that we could pull the plugs on our existing hardware and save associated costs. In determining the schedule, we at Central Michigan did not do a critical path analysis for the entire project, but relied on our own experiences as well as SCT's experiences. The due date for any one of the systems appeared reasonable, but could we stay on schedule for all systems. Looking back from the vantage point of today, I think that it is difficult for the purchaser of a major administrative software system to do a detailed critical path analysis until some of the consultation and training phases are completed and the user community on campus begins to understand <u>exactly</u> how the system works.

What does Central Michigan's implementation schedule look like today?

* On July 1, 1988, on schedule, the accounting functions of the IFIS financial system were up and running. We are still "shaking down" the system, but our daily and monthly accounting reports are coming from the new system. Presently our staff is testing fixed assets and budget preparation subsystems and also a purchasing subsystem added to the product after we had received IFIS. These latter subsystems all are expected to be in production use in early 1989.

* Key to our project management and measuring how we were fitting to our due date were:
  * weekly status meetings with agenda and detailed minutes
  * a comprehensive listing of questions/issues/concerns that we, SCT or both needed to address
  * dedicated staff

* Earlier this month (November 1988), we took a measurement for HRIS and for ISIS and have decided to change the due dates for these two projects.
  * The revised due date for HRIS (personnel and payroll) is going to be April 1 or July 1, 1989, the specific choice to be made next week. Although we believe that we will be ready for production on April 1, we may wait until July 1 for fiscal year reporting considerations.
  * The ISIS implementation dates will be put back exactly one year - admissions going-live Fall 1989 with the first registration for Summer 1990 students.

* The ADD due date is being reviewed in the context of the above revisions.

As we at CMU look back over the last 17 months of this project, we found the following major reasons (in on particular order) for the schedule changes.

* We underestimated what it would take our Computer Services staff to become familiar with the operation of the IBM hardware, the SUPRA database, and the related software.

* We underestimated what the implementation would take in terms of additional staff - both in user areas and in Computer Services - to operate the existing administrative systems as well as to learn, test, and train on the new systems.

* At CMU the SCT software was running in essentially a new environment - IBM 3090, SUPRA, latest levels of CICS and COBOL, integrated systems. Both CMU and SCT have discovered problems as a result of this environment that have slowed the implementation.

* We ran out of time to do all the necessary testing. Testing is essential to learning how the system works. Documentation by itself does not provide you all the answers to your questions.

However, while the decision to delay caused disappointment, we at Central Michigan University are not discouraged. We recognized from the start of the project that our schedule was aggressive. We have worked hard to stay on schedule; what we now know convinces us that we can fit the revised due dates.

FUNDING STRATEGIES FOR INFORMATION TECHNOLOGIES

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The information technology officer and the business affairs officer must work together closely to assure that financial resources are available to fund major computing and communications initiatives. Innovative financing techniques, use of university-related corporations, and the creation of state-level equipment trust funds have been used in various combinations at Virginia Tech to provide over $50 million in the past five years for supplemental funding of computing and communications projects. This paper discusses several of those projects and suggests ways colleges and universities may enhance their funding of information technology.

Colleges and Universities today are striving to provide the most effective and efficient computing and communications systems possible to their students, faculty, staff, and often to constituencies beyond the campus. With technological advances and changes taking place so rapidly, it is often a challenge to determine which technology best responds to program needs. Once this determination is made, the even greater challenge of funding the desired technology is given to the university's business officer. In times of competition for limited resources, this challenge is indeed very real as projects must be prioritized and funding alternatives found that take advantage of unique project characteristics. In an environment of ever changing technology, the information systems officer and the business officer are continually struggling to provide faculty and students with state-of-the-art computing and communications equipment.

Several observations may be made about the role of information technology in society and in higher education which are applicable to practically every campus:

- Information technology expenses represent a significant portion of our operating budgets.

- Academic computing capabilities and computer assisted instruction are becoming a widespread reality and computer literacy will become a fundamental requirement for an educated and productive society.

- Colleges and universities will and must move toward the concept of a paperless society through the use of computers and communications networks that will facilitate and streamline administrative processing.

- Computing and communications are integral to all facets of a university's mission: instruction, research, and public service. They are becoming increasingly important to the way we store, retrieve, and disseminate information.

- The world of tomorrow will be shaped to a significant degree by the attitude we have toward the development and application of computers and technology as tools for functioning in society.

This paper will discuss some alternatives used at Virginia Tech to fund computing and communications equipment and projects which have helped this university to be on the forefront of technology today. Over $50 million in supplemental funding beyond normal operating budgets have been provided from the

sources discussed in this paper over the past four years. Many of these alternatives represent sources of funding which do not require information projects to compete with other critical capital projects or operating budgets for limited resources. They enable the business officer to work in concert with the information systems officer to provide the campus community the best possible technological capabilities.

PERSONAL COMPUTER PROGRAM

Beginning in the mid 1980's, entering students in Engineering and Computer Science were required to have a personal computer and related hardware and software. Concern about increasing costs to students resulted in several strategies to reduce costs:

1. Aggressive negotiation of deep discount:

   - Team composed of college or department personnel, information systems staff, business affairs staff, and legal counsel.

   - Deep discount obtained for reasons of publicity, marketing, and increased presence of the manufacturer on campus.

   - Maximum cost of $2,000/student Engineering, $3,000/student Computer Science.

2. Implementation of a financing plan

   - Permit installment payments over two years at interest rate below market rate.

   - Outstanding balance on loan less than value of used equipment throughout term of loan.

   - Used cash balances in university funds with no reduction in interest compared with other investments.

   - Very low default rate. Block readmission/transcripts.

3. Creation of university operated maintenance shop.

   - Maintenance provided by Electrical Engineering Department and Lab Support Services.

   - Designated as authorized repair shop.

   - Arranged for "loaners." Campus based pickup and delivery.

4. PC Auxiliary/Bookstore

- Handled ordering, check-out and distribution through auxiliary enterprise.
- Transferred to University Bookstore.
- Sales over $3 million this year.

EQUIPMENT FUNDING

By mid 1980's it was clear that the university would have to supplement traditional state appropriations with non-traditional financing concepts if it was to take advantage of opportunities to expand its research and graduate programs and enhance its computing capabilities.

- $13 million endowment fund note issue.
- Tax exempt variable rate, put/call options. Trade 50-60% prime. Revolving "Line of credit."
- Endowment collateral at no cost.
- Letter of credit can now replace endowment collateral (1986 Tax Act).
- Flexibility to commit to projects as opportunities arise (IBM 3090).
- Increase base state appropriation.
- Favorable publicity, self-help.

VIRGINIA EQUIPMENT TRUST FUND

The favorable reaction to Virginia Tech's equipment note issue led the Commonwealth of Virginia to create the Virginia Equipment Trust Fund. Through the sale of bonds, the Trust provides funding to Virginia public colleges and universities for the acquisition of state-of-the-art equipment and replacement of obsolete equipment.

- $150 million, $90 million over first three years.
- Virginia Tech received $22 million of $90 million allocated to date.
- Did not affect tuition.

TELECOMMUNICATIONS PROJECT

An increasing demand for sophisticated communications services (due in large part to research growth and proliferation of personal computers) and rapidly escalating communications costs created a need for improvements to Virginia Tech's communication infrastructure. A decision was made to install our own voice, data, and video communications system, a $16 million project. Six primary goals:

- Control communication cost.
- Enhance the learning environment through improved voice, data, and video connections in the residence halls, academic and administration buildings, and across the state.
- Install integrated system capable of carrying both voice and data transmissions simultaneously.
- Broaden and upgrade video capabilities with a cable tv system.
- Provide faster speed for data communication.
- Replace antiquated communications cabling with new cable plant to meet university needs for next 20 years.

To finance the telecommunications project, we utilized several strategies:

- Bond anticipation notes during installation period. Variable rate. Favorable arbitrage.
- 15 year fixed rate permanent financing.
- Captured revenue from telephone, cable tv, and data connections to 8,500 residence hall students.
- Resale of long distance service to on-campus students.
- Recoveries from academic and administrative users at rates below cost of continuing previously existing system.

VIRGINIA TECH CORPORATE RESEARCH CENTER

In 1985 the Virginia Tech Foundation began the development of a research park on land adjacent to the university airport. This $15 million project, funded largely through

the issuance of industrial development bonds and a grant from the Economic Development Administration, had several goals:

- Enhance the research and graduate programs of the university by providing employment for graduate students and faculty/staff/student spouses.

- Increase sponsored research funding.

- Attract research and development laboratories to the university community.

- Assist in the economic development of the region.

An important component of the marketing plan is access to state-of-the-art computing and communications services. A decision was made to extend the new university communications system to the corporate research center, thus providing communications services not available from the local utility and direct access to the university's mainframe computer. In return, additional revenue will be provided to the computing center and to the telecommunications system. A happy coincidence is that the corporate research center afforded the most desirable location for the teleport which provides the uplink and downlink for the telecommunications system. The teleport's presence also makes a dramatic statement about Virginia Tech's commitment to leading edge technology to potential research center tenants.

FUNDING OF INFORMATION SYSTEMS BUILDING

Virginia Tech's computing center occupies center campus space on the first floor of the administration building. Other information systems departments are located in leased space off campus. A proposal was made by information systems administrators to move the computing center and telecommunications system offices to a new 55,000 square foot building in the Virginia Tech Corporate Research Center. This building, which is costing about $5 million, is financed by the Virginia Tech Foundation which will lease the building to the university.

- Financed by university related corporation issuing public purpose industrial development bonds. Variable rate, put/call options, 20 year maturity, 6.35% current rate.

- University makes lease payment equal to debt service, operating, and maintenance expense.

- University obtains lease payment by capturing revenue from terminated leases and placing a sur-

charge on computing rates.

- University obtains prime academic space vacated by computing center in center campus.

- Locating of Information Systems Building in Corporate Research Center assists in marketing the center.

COMMERCIALIZATION OF INTELLECTUAL PROPERTY

An expected byproduct of the kind of information technology environment created at Virginia Tech is computer software and other intellectual properties. Colleges and universities, with few exceptions, have historically been ill-equipped to exploit the commercialization of their intellectual properties. In 1985 a university-related corporation was established for this purpose. One of its first tasks was to take library automation software developed within Virginia Tech and find the most desirable way to commercialize it.

- Several options considered: License or sale to software company, continued development within university, establishment of for-profit stock corporation.

- Stock corporation established as subsidiary of university related corporation, which holds 55% of stock.

- Employment increase from 10 to 42.

- Major tenant in corporate research center.

- International company with offices in Sweden, Finland, Australia.

- Model for commercialization of other faculty disclosures.

CONCLUDING OBSERVATIONS

Our experience at Virginia Tech over the past five years in financing a number of information technology initiatives leads to several observations which may be helpful to others considering similar projects:

- The informations systems officer and the business affairs officer must maintain close and continuing communication. They must also encourage their staffs to work closely together.

- Effective planning is necessary to assure that

financial resources are available to take advantage of programmatic opportunities.

- Analyze debt-financed projects carefully to be certain that the terms of the borrowing (maturity, debt service costs) match the life and revenues associated with the project.

- Look to university related entities (foundation, etc.) to assist in funding and operating projects.

- Establish limits on debt exposure. Don't mortgage the future of the university for present needs.

- Be creative and innovative. Use financial and tax consultants when needed.

- Look for sources of funding that do not compete with other capital projects or operating budgets within the university.

Community Education: A Role for the Information Center?

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Continuing education directors must often scramble to meet demands for word processing, database and spreadsheet courses for the business community and the general public. Courses developed by an information center to train university staff to use microcomputers are equally suited to continuing education clients and they represent a potential resource for the harried continuing education office. Offering the Information Center program to the public under the aegis of the Continuing Education division can produce a synergistic relationship that expands the effectiveness of both units.

This paper will discuss the operating philosophy and methods that enabled an information center to respond to a need for public classes at a time when the center was hard pressed to handle its established workload. The paper will describe the problems encountered, institutional benefits realized, impact on instructors and on the Center, and long-term plans for the IC's public service effort.

Background

In the not too distant past, office automation at Northern Kentucky University consisted of electric typewriters in most offices, memory typewriters for the executive suite, and hopes and aspirations for better days ahead. This scene changed quickly in 1984 when, as part of an institution-wide computer literacy effort, one or more microcomputers were ordered for most offices on campus. A faculty-staff instructional lab was established and an information center was formed to provide the necessary instruction and software support for office personnel.

At its inception, the information center was more concept than fact. Although an excellent training facility was available, the staff training and support program began operation with a half-time support position and a pool of funds to provide stipends for part-time instructors. The program was developed and coordinated through the office of the chief information officer, the Assistant Vice President for Information Management.[1] Over the next several years the center grew to its present staffing level of two full-time people to support nearly 400 administrators and office staff. Approximately 40% of class and workshop instruction is still provided by hiring part-time instructors, most of whom already work at the University. Lack of institutional funding for non-faculty lines currently prevents any further expansion of permanent staff for the center. However, the general workload continues to increase in proportion to a rapidly increasing number of microcomputers available in University offices. Moreover, as the expertise of Information Center clients increases, the challenge of meeting more sophisticated instructional and consulting needs becomes greater.

During the period from 1984 to 1987, the Continuing Education office fielded numerous requests for noncredit computer classes for personal interest or professional development. The few classes offered were always oversubscribed. The Continuing Education director was unable to receive access to any of the several instructional computing labs on campus

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[1] The process and problems of "bootstrapping" the young information center were reported at the Cause National Conference in December 1984.

because they were fully committed to classes in degree programs. As an alternative, the Director made arrangements to use microcomputers at several area high schools and at an area technical school. Software was not provided by the area schools and the director found it a continuing challenge to locate competent instructors who also had access to the software needed to support their own classes. Most courses relied on public domain software, which served to introduce computer concepts but did not respond to the growing interests of the business community for classes in popular commercial software. Even with these limitations, the continuing education computer classes had waiting lists for enrollees.

The initial idea of combining forces with the Information Center to offer classes to the public occurred after a staffing crisis in the Continuing Education division. When an instructor quit two days before a scheduled computer literacy class, a panic call was made to the Information Center consultant to ask him to teach the class. The consultant was willing, but requested permission to use the faculty-staff training lab because software and related course materials would be available for use with the lab. The training facility was available for the requisite evenings and the class was moved on campus and successfully completed. The Continuing Education director raised the question of continuing to use Information Center staff and the lab facility whenever available, to expand Continuing Education program options.

The Continuing Education Director believed that a strong market existed for courses with specific office and business focus. The curriculum developed and implemented by the University's Information Center for campus personnel included courses that would be directly applicable to the needs of the public. Thus, the possibility emerged for a joint program to provide courses for the public. The idea was intriguing, Information Center staff were enthusiastic and the University's chief information officer was cautiously supportive.

Situation Assessment

Could we offer Information Center classes to the public? There were a number of reasons for considering the possibility. The Information Center's mission included development of a computer literacy program for university office personnel as well as continuing responsibility to support automation of university offices. Toward these goals, the Information Center implemented a computer literacy curriculum that focused on the knowledge and skills needed by office managers and support staff. At the time discussions began with Continuing Education, the Information Center offered its University clients a full program of classes and workshops in general computer concepts, management issues and concerns, word processing, database, spreadsheet and graphics. The established program was defined down to the level of instructor guides, workbooks and lab materials. Furthermore, the instructors who taught the classes had accrued considerable experience in teaching adult learners, including adults who were initially uncomfortable with, or intimidated by, the prospect of mastering automation technologies. Indeed, it appeared that the Information Center program might be the ideal vehicle to offer to the public, both for professional development activities and general community education.

Moreover, the faculty/staff training lab was seldom used evenings or weekends, the time periods when continuing education activities were at their peak. Also, because Continuing Education instruction focuses on weekends and evenings, some of the Information Center staff and instructors might be available on a part-time basis. Initial discussions revealed that sufficient instructors would be available to support an evening program.

However, a number of barriers to a successful joint venture had to be addressed before any commitments were made. Among these were the need to carefully articulate the expectations and responsibilities of both offices and to insure that appropriate executives were aware of the project and in accord with the concept. Needless to say, nothing about the pilot fit within established organizational, budgetary or accounting procedures at the University. Continuing Education is part of

Academic Affairs and the Information Center reports through Administrative Affairs. It was essential that both Vice Presidents were willing to have their units participate in the joint venture. Further, the Budget Office had to be convinced of the legitimacy of the project. One "minor" problem that ultimately consumed major blocks of time was the need to idenfity an approach to budgeting and distribution of funds generated by the activity. At the outset, it seemed logical to pay all expenses (advertising, mailings, materials, instructor fees, etc.) and divide any remaining funds between the two units.

Despite some concerns about how to accommodate the non-traditional venture within established organizational and budgetary frameworks, all parties agreed the project had merit. Also, because the lab to be used for the project is a shared resource with the Office of Academic Computing, it was essential to develop a program that would fit within the half-time schedule available to the Information Center. After additional discussions, we decided to proceed with a pilot project.

The Pilot Project and How it Grew

The Pilot project started during the 1987 spring semester with two distinct areas of community support, and shortly expanded into a third:

The first area for the pilot focused on an expansion of the established Community Education program to serve the general public need for less intense, generalized training. Specific topics emphasize basic computer literacy, consumer education and general computer awareness.[2]

The second component of the pilot was a series of Professional Development courses, geared toward the professional business person needing immediate intense training in spreadsheet, data base and word processing applications.[3]

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[2] Ray Scott, Office Automation at Northern Kentucky University: Community Support, Spring 1987.
[3] Ibid.

A third component was added after the director of the University's Reemployment Center sought assistance in obtaining computer training for clients of the Center. The Reemployment Center administers a federal grant program to serve displaced workers and long-term unemployed persons in need of introductory training oriented to acquiring new marketable job skills. Because of the increasing emphasis on technology in the work place, the Director of the Reemployment Center believed that an introduction to computers as a business tool would be a valuable addition to the reemployment program. After further deliberation, the Information Center developed a special workshop for the program.[4] This eight-week workshop is comprised of 28 hours of business computer literacy designed to interest individuals in further training. The four introductory areas include operating systems, word processing, spreadsheet, and data base.

Program Review and Assessment

Since the early phase of the project was an extension of the Information Center's existing program, no major hurdles were encountered in developing the first session of classes. Each course and workshop was monitored by Information Center management to determine its effectiveness. Student evaluations of instructors were an integral component of this process. In all cases instructors were carefully selected to teach workshops in specific areas of expertise where their talents had been identified based upon practical experience. In some cases where weaknesses were identified, it was possible to move an instructor into another area where greater competency was demonstrated thereby allowing us to change the weakness into a strength.

The real surprise to the Information Center was the major commitment of administrative time initially required. Many hours were consumed in coordinating the project with executive offices, and in trying and discarding several alternate budget and recharge methods before procedures were finally established. Additional time was needed to contact and schedule instructors. Also, much more time than anticipated

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4 Ibid.

was needed for continuing lab support. It was a time-consuming process to assemble materials and set up and restore the training lab for each class and workshop session. Ultimately the Information Center established an alternate mechanism: Individual "support packs" were developed for each class, consisting of operating system and program disks, student files, workbooks, manuals and other associated materials. This eliminates the need to constantly reorganize materials for different classes. With that situation corrected, approximately two hours per week are now sufficient to maintain the original lab.

Starting with an initial program offering only four computer courses, this joint project accomplished the successful delivery of 21 classes during the first full year in operation and served 278 students. It also resulted in expanded revenues for the Continuing Education program and new money to the Information Center. Revenue generated from these courses permitted the Information Center to fund one additional part-time employee.

Another major impact from this project was increased visibility with top management. To the delight of NKU's president, we were able to offer competitively priced computer classes, comparable to those administered at neighboring institutions, to the general public at a time when budget constraints precluded expansion of any kind. More importantly, students were provided an introduction to the university and its facilities that could well lead to further interest in pursuing formal instructional opportunities at NKU.

Instructors initially were extremely enthusiastic and supportive of the evening program. It not only represents an opportunity for additional earnings, but also provides increased visibility within the campus and broader communities and recognition for technical expertise. As might be anticipated, some disenchantment set in as the program grew larger, and some of the initial pioneering spirit lags. A number of operating hurdles, including over-enrollment in some class sections, and lack of appropriate communication proved frustrating to instructors. As problems arose, they were

addressed and instructor satisfaction with the program has been restored.

Next Steps: Consolidation and Expansion

The initial pilot series of activities had not been completed before plans were underway to continue and expand operations. Because of the lengthy advance scheduling required for publication and communication with potential students, we had to either make an early decision to go ahead or have a hiatus in the schedule during which computer courses would be unavailable for the public. Early results were promising and we decided to continue for the 1987-88 academic year. Completion and final assessment of the pilot project supported its value to the University. Continuation of the joint program, as long as a market exists for the classes, was now planned. Several memos of understanding were developed to formally establish operating guidelines for the future.

During the academic year, it became clear that an expansion of the program was needed. However without additional lab facilities, expansion was impossible. The two offices decided to pursue the possibility of adding a new instructional lab to be financed by the revenues earned from the noncredit courses.

Working with a local vendor, a proposal was prepared which would allow the university to purchase computers for a public lab at a rate well below our established educational discount, and far below retail. A formal business case was developed by the offices of Continuing Education, the Information Center and the Assistant Vice President. A request was made to the appropriate Vice Presidents and the Budget Office for funding to allow the acquisition of the microcomputers, software and other equipment needed to establish a new computer lab. Net revenues generated from Professional Development computer training workshops would be earmarked to repay the university's fund balance account.

A loan of this nature was the first of its kind at the university and posed potential questions of budgeting, ownership, operational jurisdiction, etc. To guide implementation, an operating agreement was written to outline

priorities for use and access procedures. The loan was approved and advanced by the university for acquisition of the new lab. A flurry of activity followed during which the new lab site had to be prepared, equipment, software and supplies ordered, and an agenda prepared for its use. The new lab was available for classes beginning in September 1988 and a total of 17 classes were scheduled for the Fall semester. One component added to the lab schedule was the accommodation for two credit courses that generate financial credit which is to be applied to the liquidation of the computer lab account. An immediate impact of the new lab was that, although activity level has increased, "spendable" revenue is down until the lab cost is repaid to the University.

Final Thoughts

In retrospect, would we do it again, if we were to start over? Our answer is "Yes, but..." We would take additional time to define responsibilities in greater detail and to have written confirmation of the internal costing and billing procedures before starting the program. Additional attention to details would have avoided numerous "loose ends" and provided smoother implementation for the program. Overall however, the community service program is a positive influence on the Information Center, its personnel and its ability to provide additional service to University offices.

The economic outlook for Kentucky and the University system over the next several years is bleak. As the likelihood of personnel and budget expansion diminishes and University demands on the Center increase, the Information Center is actively investigating other options for generating revenue. The Center continues to propose new and innovative programs to extend and enhance its current services to the public, and thus indirectly, to the University. At the present time one grant application is under development which would further extend information center services to the northern Kentucky service region. Other grant applications are being considered. Any new ventures will be based upon promoting the proven expertise of the Information Center.

By offering its expertise to serve the public, it appears that an avenue is available to ultimately provide increased support for the Center and its University clients.

BUILDING STRATEGIC PARTNERSHIPS WITH INDUSTRY

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ABSTRACT: Limited state funding prohibits universities from acquiring information technologies to adequately support academic programs and administrative services. Institutions are increasingly supplementing their computing and communications budgets through industry partnerships. Of nineteen campuses in the California State University (CSU) system, over one-third of the current inventory of industry-donated computing equipment, ranging from student terminals and advanced workstations to large mainframes and complex software, has accrued to Cal Poly, San Luis Obispo through various partnerships with industry. Based on Cal Poly's experience, elements required for de eloping successful university-industry partnerships are explored.

INTRODUCTION

In this era of limited resources, institutions of higher education are finding it more difficult to meet their basic mission, goals and objectives. Increasingly, they are turning to private industry to supplement state funding of university programs and activities. Information technology requires substantial commitment of resources and dollars to retain academic accreditation, expose students to those tools that are required in their chosen professions upon graduation, and manage the day-to-day administrative activities of the university. While private universities have long recognized the advantages of such support, public institutions have only recently turned to private industry sources for assistance.

BENEFITS

The relationship between universities and industry is basic. Universities train students to enter the world of work upon graduation. However, to be productive employees, students must learn their advocation on state-of-the-art equipment used by those industries. This is even more critical since information technologies are now a fundamental part of nearly every aspect of modern life. Unfortunately, the nature of institutional funding cycles and procurement processes prohibit a rapid turnaround in technology acquisition. Therefore, it is to the advantage of industry to make such technology available to the university at lower cost or through special arrangements. This can minimize the time lag, speed up the educational process, and result in product innovations which directly benefit the industry sponsor.

Obviously, the primary benefit to institutions is direct industry funding or in-kind gifts to replace, upgrade and expand computing systems and facilities. However, universities directly benefit in various ways as shown in Attachment 1. Paying students to work on specific projects or work assignments, using faculty as paid consultants and researchers, and using industry leaders as consultants and advisors to the university are examples of industry-university partnerships. There are indirect benefits as well. By taking a proactive approach to developing partnerships with specific hardware and software vendors, the university is better able to effectively direct development of the information resource environment. At the same time, partnerships can bring the institution into the forefront of computing on a regional or national platform. This can generate interest from other vendors and increase the institution's visibility among its peers. This often results in further partnerships and projects which can aid the university in development, recruitment and other critical activities.

TYPES OF PARTNERSHIPS

Partnerships can take many forms. They can involve academic or administrative computing or both. They can range from small-scale to large-scale projects. A small-scale project might involve a donation of a single networked lab for classroom instruction, one or two faculty workstations for development purposes, or discounts on computing equipment for faculty, staff and students. A large-scale partnership might generate new products, provide campuswide mainframe support, or employ a complex research and development project involving multiple institutions.

The extent of an institution's involvement in partnerships depends upon the resources and other elements which can be brought together by the institution and its industry partners. In general, such partnerships develop along a common evolutionary path. Initially, there may be limited contacts at the department or school level involving individual faculty and/or alumni from industry with specific interests in campus support projects. As these contacts develop, an institution may eventually reach a point at which it proactively pursues industry partnerships which benefit the entire campus. Finally, the campus may be actively wooed to participate in specific industry-sponsored projects or activities. When activity reaches that level, it is beneficial to have a unit specifically established to serve as broker or contractor for a wide variety of industry-related projects.

INGREDIENTS FOR A SUCCESSFUL PARTNERSHIP

A number of factors must be present for industry partnerships to be successful. First and foremost, the university and its Information systems organization must have a clear sense of mission or direction and well-defined goals and objectives. Secondly, the university must develop a strategic plan by which it can achieve its goals and objectives in the allotted timeframe. This plan should identify program needs, areas of strengths, and opportunities for new program development. Another critical element is a strong unified team approach to partnership building by the university. The team should be comprised of representatives from the Information Systems organization, University Relations, Research and Development, Academic Programs, Business Affairs, and industry. The support of the President and other high-level executives as well as the faculty is also necessary to support commitment of the necessary resources to make the project successful. An industry advisory council or board is also helpful in successfully building and sustaining industry contacts. Finally, the campus should identify alternative approaches in case the partnership option proves unsuccessful or short-lived. In general, however, if an institution can deliver, industry will continue to be supportive of that institution's goals and objectives. In other words, success will breed success.

CAL POLY/INDUSTRY PARTNERSHIPS -- AN EXAMPLE

Cal Poly, San Luis Obispo has been very successful in building partnerships with industry over the years because of the elements listed above are. By 1985, Cal Poly had a defined mission and was establishing a strong Information Resource Management organization. Since then, the campus has actively pursued a wide variety of industry partnerships based on a strategic plan developed by the university and a dynamic team approach. A major force in Cal Poly's success to-date has been the existence of the President's Advisory Cabinet. Many cabinet members represent high technology industries which have contributed substantially to the university, including IBM, Hewlett-Packard, Tandem, PG&E, Xerox, Apple Computer, and Northern Telecom. The following is a brief recap of the nature of these partnerships and the benefits derived by the university.

1. **IBM**

   The Cal Poly/IBM partnership extends over three divisions within IBM and has existed since 1983. Cal Poly receives support for

faculty research and student instruction in the areas of CAD/CAM, artificial intelligence, expert systems, and other areas of interest through IBM's General Products Division. GPD provides mainframe hardware, software, maintenance and other support to these projects. GPD also hires several Cal Poly students through the university's large Cooperative Education Program and funds faculty and student research projects. IBM's Academic Computing Information Services (ACIS) organization supports the university on two fronts. ACIS is one of the major contributors to the OASIS Project to develop a new administrative computing environment at three CSU campuses, including Cal Poly. They also support academic computing by making mainframe software available at substantial discount through the Higher Education Software Consortium (HESC). As a CADAM grantee school, Cal Poly was one of the first institutions to join HESC. The university is a key participant in the new venture. Finally, IBM's Education Systems Division donated a student lab to support computer-based education, research and instruction at the campus. This relationship is continuing to evolve. In addition, the local IBM representatives have negotiated with the campus bookstore to make IBM PS2 equipment available to faculty, staff and students at substantial discounts.

2. INFORMATION ASSOCIATES (IA)

In conjunction with projects involving IBM and Apple hardware, Information Associates provided the campus with mainframe software to manage student records and other critical information. IA also gave Cal Poly copies of their Executive Support Systems software for microcomputer and mainframe environments. These packages will be used to develop an integrated administrative computing environment at Cal Poly.

3. HEWLETT-PACKARD

The relationship with Hewlett-Packard extends back over many years. HP has supported academic computing in several ways. They have given Cal Poly many workstations to support student instruction. For example, HP donated student labs to Business and Engineering, advanced workstations to Mechanical Engineering and 100 new terminals to support IBM mainframe. HP has supported faculty development projects with advanced workstations. With an Executive Vice President from HP serving as head of the President's Advisory Council, HP continues to be one of the strongest supporters of the university.

4. APPLE

In keeping with its founder's philosophy, Apple Computer has long advocated the integration of microcomputers in courses at all levels of instruction. At Cal Poly, Apple technology is widely used in such disciplines as Architecture, Agricultural Engineering, and Graphic Communications. The Macintosh is

now the second leading microcomputer operating system on campus. More recently, Information Systems negotiated with Apple to offer a special discount program to students, faculty and staff through the bookstore. Over 1,000 MACs were purchased during the two-day sale. Based on this demonstration of interest in Apple technology, Apple donated $350,000 worth of Macintosh equipment to support various instructional programs. A key consideration for Apple was the fact that these systems will be used by faculty to develop applications within their specific disciplines.

A second project involving administrative computing was also undertaken during the last year. With equipment and software donated by Apple, Cal Poly will develop a version of Information Associates' Executive Support System using MAC technology to access IA's IBM-based mainframe applications. Apple also funded salaries for two students earning college credit through the university's Cooperative Education Program to develop the new ESS product.

5. **PAC BELL/NORTHERN TELECOM**

The breakup of AT&T several years ago provided the impetus for exploring alternative communications services. Because of its long standing relationship with Pacific Bell, Cal Poly was able to negotiate a highly favorable contract for Centrex telephone services. This partnership will eventually result in the campus being able to achieve its long desired goal of an integrated computing and communications environment through implementation of standard network architectures and digital service. Information Systems will use the savings realized by the telephone service contract to meet other telecommunications needs. Northern Telecom has aided the university by funding research in human factors engineering and computer integrated manufacturing. More recently, they loaned one of their executives to the campus for one year to explore the possibility of developing a Computer Integrated Manufacturing Center at the campus.

6. **TANDEM**

In 1987/88, Tandem Computers donated workstations, file servers, printers, networking and software valued at $1 million to support instruction in basic computer literacy. They also provided workstations to Computer Science faculty responsible for developing the computer literacy course curriculum.

These six partnerships represent a substantial investment in computing and communications equipment roughly equivalent to $15 to $20 million in equipment and services over the past two years. Given the existing budgetary constraints on the university, it would have been impossible to provide this level of service without industry support.

A GUIDE TO SUCCESSFUL UNIVERSITY/INDUSTRY PARTNERSHIPS

Once the university has developed its strategic plan and identified specific goals and objectives to pursue, the following steps may serve as a guide in cultivating industry/university partnerships:

1. Develop a list of appropriate corporations and executives.
2. Identify past and current relationships with corporations and executives.
3. Ascertain strength of relationships with corporations and executives.
4. Develop advantages for all parties.
5. Contact corporations and executives for preliminary discussions.
6. Assess synergy.
7. Present complete plan to all parties.
8. Reach conclusion on projects - go or no go.
9. Identify aggressor catalyst.
10. Identify consensor.
11. Continuous strategy modification.
12. Monitor progress and refine project.
13. Step into the pocket, quarterback.
14. Worry, depression.
15. Raise the flag.
16. Victory celebration.

CONCLUSION

By following some of these strategies, other institutions can successfully negotiate partnerships with industry to benefit their Information Resource Management goals, whatever they may be. The main thing to keep in mind is the quid pro quo nature of industry partnerships. To be successful, such partnerships must be a "win-win" effort for both parties.

For the university, it is most important to keep in mind the ultimat goal of improving student services and academic programs by providing the most computing resource at the least cost to the instructional program. A strategic partnership which fails to deliver the expected results to the university or industry will end all prospects of future support and, thus, do more harm than good. Ultimately, it is the impact on students and faculty which matters most. By involving faculty and students in the partnership-building process, the university can be certain that the project and its goals will be accepted.

Cal Poly's success can be attributed in large part to the involvement of a dedicated group of faculty and administrators who have actively sought industry support to further the goals and objectives of the university. With a cohesive vision and sense of direction for Information Systems, Cal Poly has been able to successfully negotiate strategic partnerships with industry and other institutions. Through these partnerships, Cal Poly students are now beginning to realize the benefits of a state-of-the-art computing environment. While much remains to be achieved, the university is on the verge of becoming an "electronic campus" within three to five years. And, undoubtedly, industry support will play a large part in the university's ability to realize its goal of an integrated computing and communications environment.

Attachment 1

UNIVERSITY/INDUSTRY PARTNERSHIPS

- Advisory Board Participation

  University
  School
  Department
  Program

- Recruiting Students
- Co-op Students
- Senior Projects in Real World
- Design/Problem Solving Classes
- Executive Exchange Program
- Faculty Consulting
- Applied Research Opportunities
- Corporate Speakers for University/Student Activities
- Faculty Summer Employment
- Opportunities to Upgrade Laboratory Equipment
- Opportunities to Develop State-of-the-Art Laboratories
- Interdisciplinary Approach to Education
- Enhanced Corporate Visibility on Campus
- Graduates Better Trained
- Helping Meet California's Technical Manpower Requirements
- Increased Hiring Rates
- Faculty Knowledgeable of Current Technology

USING COMPUTER MODELS TO CONSIDER COMPUTER CENTER GROWTH OPTIONS

CAUSE88
Information Technology: Making It All Fit

Judith V. Douglas, University of Maryland
Donald E. Harris, Messiah College

The Setting

The Campus. Located in Baltimore, the University of Maryland Professional Schools Campus is an urban campus including schools of Medicine, Dentistry, Law, Nursing, Pharmacy, Social Work and Community Planning, and a graduate school shared with its sister campus in Baltimore County. Part of the University of Maryland, the campus is subject to a multilayered bureaucracy. Campus decisions and priorities are set by the President, but must be approved by the Chancellor of the University of Maryland and his staff within System Administration. In turn, the University as a whole is answerable to the state, through a specific agency responsible for reviewing its planned acquisitions. All budgetary matters must pass through these three layers of campus, university, and state preparatory to legislative approval.

As an academic health center, the campus has complex interrelationships with the University of Maryland Medical System (UMMS), notably the University Hospital and the Shock Trauma facility on the Baltimore city campus. The schools offer 62 degree programs and residency programs in 20 medical and three dental specialties. Enrollment for fall 1986 was 4,563; the employee population of 3,936 included 915 fulltime and 336 parttime faculty. In fiscal year 1986, total campus revenues were \$169,527,435, of which almost \$77 million (46%) were state general fund dollars. Grants and contracts generated over \$43 million (26%).

The Computing Center. The Information Resources Management Division (IRMD) is the unit on campus responsible for meeting academic and administrative computing needs. Reflecting the importance computing holds on an academic health center campus, the IRMD has over fifty employees and is the responsibility of the Associate Vice President for Information Resources (AVPIR). The AVPIR reports directly to the President who also chairs a governance committee made up of the deans and other administrative officers. This Information Resources Management (IRM) Policy Committee advises on policy issues affecting both the IRMD and the Health Sciences Library.

The place of the IRMD in the organizational structure for the campus dates from 1984, when the newly created AVPIR position was filled. The untimely death of the President less than three months later voided informal commitments to additional funding for information resources This combined with a history of deficit spending placed the IRMD in a precarious position. As a result, demonstrating fiscal responsibility became one of the IRMD's prime goals. As the timing of budgetary cycle precluded any major changes during his first year, the AVPIR moved to resolve the deficit by laying off three employees and controlling operational expenses, while reinstituting contributions to the depreciation account and maintaining funding for training and professional development. These measures gave the IRMD new credibility.

The subsequent year's budget request set forth three levels of funding and described the level of service possible under each. The new President and the Director of Budget supplemented state appropriated funds for the IRMD with campus monies under the President's discretion, in effect granting the IRMD the highest of the three levels.

Planning for Growth. At the same time, the AVPIR worked with the President and the IRM Policy Committee to obtain approval of a campus plan for information resources, developed with the support of a contract from the National Library of Medicine. This plan provided two strategic alternatives and identified the costs associated with each over a seven year horizon. These were reflected in the state mandated planning documents as well. However, before funding for the plan could be identified, the AVPIR left the University of Maryland and the position was filled on an ad interim basis by the newly recruited Director of Academic Computing for eighteen months, at which time she was made permanent.

During this interim period, funding remained essentially level. Although the IRMD continued to prepare for the strategic direction identified in the plan, the campus made no definitive decisions regarding alternatives or funding. The concern of the acting AVPIR that fiscal responsibility be maintained led her to retain Donald E. Harris, who had been Director of Administration during most of the first AVPIR's tenure. Now a faculty member at a nearby college and an independent consultant, Dr. Harris advised on the financial management of the division, working with his successors in the director position at Maryland, as the IRMD continued in a state of organizational flux.

The Model Building Process

Preparing for Model Building. The process of building, testing, and operating a computer based model follows a well defined set of steps. In the two to three years prior to this modeling activity, the IRMD had fulfilled one very important prerequisite, becoming one of the more proficient users of reports and query language processing available on the University's existing financial systems. In addition, IRMD staff developed inhouse tools, using traditional programming languages on campus minicomputers and spreadsheet and database software on divisional microcomputers to track their own accounts payable and receivable.

This effort proved invaluable in determining the base year for the model and in knowing how to make "intelligent guesses" about possible future activity. In a process that is often flawed because available data are substituted for needed data, the development of these tools helped to insure integrity of the model for both the IRMD staff and the campus Budget Office.

Providing an Educational Process. One of the goals of the modeling activity was fulfilled by the process of building the model. Former modelers have repeatedly stated that being forced to define model variables, relationships, growth assumptions, and constraints, provides an education quite apart from actually running the model. Thus the consultant deliberately involved senior IRMD staff as a group in the model building process. Seeking input from many sources, including some outside the division, had a number of visible benefits. Prime among these was the shared responsibility for the accuracy of the data that went into the model and for the integrity of the model itself. Because emphasis was put on keeping the model simple (even having a spreadsheet version), IRMD personnel were able to understand some basic concepts of modeling without having to learn another software package.

The goal of education was realized during the model building period. The consultant did not stress numbers or solutions to the IRMD's financial problems. Rather, by focusing on what could be learned about the way the division operated, he took the process beyond the division's budget office and made senior management active participants.

Structuring the Summary Report. The first step of the consultant and his project team was to identify the budget areas to be included in the model. To make its findings easily understandable for those senior managers in the IRMD and the Budget Office who would review it, the summary report of the model was structured to look like the summary reports those managers received each month. However, unlike those monthly reports, the model did include the revenue items for carry-forward of previous year's surplus and various new equipment and personnel on the expense side. To give a target to shoot for, the model used the current year's actual as its base year and the upcoming budget year as the first year in its forecast.

Identifying the Variables. In preparing the model, the challenge was to determine the primary planning variables which drove the change in the defined revenue and expense categories from year to year. Self generated income was broken down into academic and administrative areas. Within these areas, further breakdowns came in terms of various user groups which might share some common pattern of usage such as special research grants on the academic side or auxiliary enterprises which bought time on the administrative machines. Once identified, major users were given their own line in the model.

Assigning Growth Factors. Growth factors were then assigned to each of the user groups, including a common growth factor on usage for all users and separate growth factors for each of the various user groups, such as research grants or auxiliary

functions. The model thus had the option of either driving all self generated accounts together, or adjusting each of a number of groups based on separate assumptions on their usage of computer resources. The final variable in this area was that of rate for computer time. The IRMD's current common rate was placed in the model with a growth factor tied to it.

Establishing Relationships Among the Variables. To allow for relationships among variables, detail was built into the model whenever it could be justified; otherwise, the model was kept as simple as possible. In the area of operational costs, separate sections were established for the division's five minicomputers and one mainframe. This allowed inclusion of exact dollar figures for payments on several of the machines and reflected the wide variation among machines for contractually determined services such as maintenance and software leases. Detail was also purposely included in the new expense area. The model was built to accommodate the addition of personnel in the forecast period and to automatically generate benefits and indirect costs according to the level of the new employee(s). Again, input from a variety of sources insured good assumptions on data such as salary levels, expected growth rates in operational areas, and even expected interest rates should a major loan be sought.

Loading the Base Year. Once the component parts of the model were defined, the base year assumptions were loaded. The challenge here was to determine the factors that make up various budget categories rather than just the dollar figures for those categories. To determine factors affecting self generated revenues, the IRMD ran reports on its accounting programs for different systems to determine the usage of machine resources by group of "paying" customers and even by time of day (the IRMD offers discounts for evening and late night use of machine resources). Once the base year was loaded and inconsistencies with actual budget figures were resolved, a set of assumptions was developed for growth in all areas.

Validating the Estimates. To improve the accuracy of the estimates, information was gathered from a number of sources. Campus users were surveyed as to their plans for future computing activities; a telephone poll was conducted with key users. Vendors were contacted for estimates on how much maintenance cost might increase. Information was collected on what the costs associated with acquiring new hardware and software would be, including personnel. Thus, decisions on growth options could be based on dollar figures that could be traced back to specific documents. The consultant worked with IRMD management to stress the fact that, although these assumptions were not in any way guaranteed, they represented the best guess at what potential costs would be in future years.

Establishing Constraints. The final step in defining the model was to determine the constraints for certain variables. The consultant and his project team realized that running the base year out with the growth assumptions in place would produce a deficit forecast before any additional personnel or machine resources were even considered. Thus the task became one of trying to bring the forecast back in balance using various goal seeking features of the modeling software package. Doing so required defining what variables should be constrained and what high and low values

should be defined for these variable values. To keep the process simple, only one constraint was placed on the actual budget figures: there could be no deficit at the close of any year of the forecast. To provide a balanced budget each year of the forecast, a constraint was also placed upon the equipment depreciation fund. The remaining constraints were placed on revenue and expense growth assumptions, always in consultation with key directors in those areas.

Applying the Test of Reasonableness. Here again the attempt was made to keep the process honest by not seeking solutions to the division's financial problems that were unreasonable from a growth perspective. For example, computer usage by cash customers could not reasonably be projected to grow by more than 10% per year given the proliferation of microcomputers on campus. Thus the consultant and his project team did not allow the modeling software to seek a solution to a budget deficit by increasing growth in that area past the high level of the constraint. This process was followed throughout the model.

Conducting the Sensitivity Analysis. After the model was defined and thoroughly tested, one final step preceeded its actual use in addressing possible planning scenarios. A sensitivity analysis was conducted to ascertain that the model was not defined in such a way that it was either too sensitive or not sensitive enough in representing changes and their effect on the entire budget. Ideally a model should show some changes to have a ripple effect upon the budget, such as the increases that may be seen in personnel benefit areas, travel, conference registrations, and the like when a new professional staff member is added to the division. Yet these effects should be reasonable, not overstating the actual expense that would be incurred.

The sensitivity analysis went through each primary planning variable and changed the growth by a factor of 1 or 1% (as the case may be) and then looked at the summary report for the model to examine the effects the change had on various parts of the model as well as the bottom line. A final summary sheet was then produced showing the relative bottom line of a variety of changes to these primary planning variables. Through this process, some minor changes were made to the model. Again, involving individuals not on the project team in this phase of analysis served to establish the model's integrity in many minds both inside and outside the IRMD.

Using the Model to Seek Feasibility

With the model established and tested, the work of addressing the financial concerns of the division began. The course of action was to examine three possible planning scenarios for the IRMD in the coming years:

o Scenario 1: No growth.
Existing machines, software resources, and personnel would be maintained. Revenue and expense areas would grow in accordance with assumptions set forth in the model.

o Scenario 2: Limited growth.
User services would be increased. No substantial upgrading of resources in terms of an upgraded mainframe or database package would be allowed.

o Scenario 3: Moderate growth.
Machine and software resources would be upgraded and personnel added.

Accuracy in estimating hardware, software, personnel, and maintenance costs was key to the validity of the numbers in the second and third scenarios. Some numbers were obtained from vendor estimates on possible packaging of equipment or software lease costs already known to the IRMD. Personnel costs were checked against salary studies for the area, double checked by the Personnel Office, and then tied to inflation. Thus, if a particular personnel position was planned for year three of the forecast, an inflation factor had already increased the base line for that item so that year three was adjusted for inflation. The campus Budget Office provided loan interest information; if any scenario called for the borrowing of funds, reasonably accurate interest rates could be projected. Again, although various campus offices provided valuable information for the model, the ultimate payoff for involving them was the shared ownership of the modeling process.

As predicted, each of the five year forecasts showed a deficit situation that grew worse as the forecast went on. The consultant and the project team therefore focused on what could be done to make each scenario feasible. The task was to adjust primary planning variables to meet the constraint of a balanced budget without breaking any of the established constraints on the growth variables. IRMD staff were again consulted to determine where costs could be cut without jeopardizing the individual scenarios. The object was to insure that the goals and objectives of each growth scenario were not compromised. Thus some additional personnel were taken out under the assumption that present personnel could be trained, or that hiring of personnel or the acquisition of equipment could be delayed one year. However, when the impact of such changes upon goals and objectives was assessed, items cut from the forecast were often reinstated.

The focus quickly shifted from cost saving measures to the possibility of using the depreciation funds earmarked for equipment replacement and supplementing them with additional funds from the President's office and perhaps a special low interest loan. After several passes at the model, a set of revised planning assumptions was established for each of the three scenarios to provide for a feasible five year forecast. Although the IRMD clearly sought the moderate growth scenario, all three scenarios were written up and presented in a final project book form to the campus Chief Budget Officer.

Outcomes

Since the modeling process was completed, the IRMD has received additional funding supportive of the moderate growth scenario. A significant portion of this funding has replaced special one year appropriations from the President's discretionary funds with

ongoing state monies. Funding has been granted for additional positions. Potential funding sources, including the depreciation account, have been identified for the support of major acquisitions. In addition, the campus has identified computing needs as the second highest priority for the campus in the state budgetary process.

Though real and measurable, this increased funding is not the only important outcome of the modeling process. The IRMD has also benefitted as an organization from the educational process. These IRMD staff members have effectively shared their understanding of the dynamics of the IRMD budget with the campus Budget Office. The no growth scenario made clear the financial problems facing the IRMD. Due to unavoidable increases in costs in critical expense areas, even no growth required additional funding to avert a deficit situation. The mechanisms the IRMD was using to maintain budgetary flexibility became obvious; the trends affecting areas such as software maintenance and self generated income were highlighted. The campus Budget Office has acknowledged these trends. Indeed the Budget Office is phasing in additional funding on an annual basis to offset decreases in self generated revenues.

This awareness of the dynamics of the budget had a positive effect on IRMD personnel. Those staff members with experience previously limited to organizations of fewer than 20 staff members and commensurately smaller budgets were made aware of the flexibility that a budget the size of the IRMD's provides and the constraints it entails. For other staff members, the model succeeded in validating trends previously intuited or inferred and in giving them dimension and measurability. Overall, the modeling process helped to mature the IRMD and to bring it beyond the "live for today" philosophy that once placed it in financial jeopardy.

Today the IRMD is distinguished by its attempts to plan for tomorrow. Efforts are underway to build into the forecasts those items that will help the division meet its goal of creating a new information environment for the campus. The campus and the IRMD are finding that there is more today because of the effort that was made yesterday. The bottom line here is that the division is in a better position now than at any other time to address the information needs of its campus.

Track IV
Organization and Personnel Issues

Coordinator:
Albert L. LeDuc
Miami-Dade Community College

Once a direction has been set by policy and planning, organization and personnel issues emerge as critical issues. Not only is it important to determine where information will be created, preserved, and communicated, it is equally important to determine what information resource functions will be included in the organization.

Papers in this track describe individual institutional approaches to organizing and staffing the information resource management functions to meet the needs of the institution.

(From left) Lawrence A. Jordan, California State University / Los Angeles; Gerald McLaughlin, Virginia Tech; Karen L. Miselis, University of Pennsylvania; and Ronald Hoover, Penn State University

Janet Wixson, University of Alabama / Birmingham

Positive Management
Techniques and Retreats

Janet Wixson
The University of Alabama at Birmingham
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Alabama

Computer center directors bear the responsibility for creating dynamic, encouraging, and effective environments which maximize the resources within their charge. Positive management techniques yield great benefits in areas such as group effectiveness, problem solving, and staff commitment. This paper defines some of the qualities necessary to a positive environment, suggests some easy methods to gauge your organization's attitude, and addresses some simple methods of developing a fundamentally positive management philosophy. Particular attention is given to the management retreat process that has proven so effective for our computer center. Basic guidelines are presented to assist an organization wishing to implement a management retreat.

A few months ago, The University Computer Center (TUCC) of the University of Alabama at Birmingham (UAB) received, at our request, a peer review from The University Computer Center Directors Special Interest Group of ACM. A peer review consists of three data processing directors from member academic institutions generously donating their time to visit your facility. They interview both the computer center staff and your user community. Upon completing their investigation, the review committee prepares a written report outlining their conclusions. The group's findings present the director with an objective analysis of such vital areas as service, user satisfaction, staff competence and morale.

Our peer review shows an exceptionally high degree of satisfaction in our user community, an unusually positive attitude among the computer center staff, a very low personnel turnover, and a high degree of productivity relative to application development and maintenance. This has not always been the case. As a matter of fact, in 1980, the situation was so bad that the university was seriously considering contracting our administrative data processing activities to an external managemen firm. The environment at that time was characterized by an annual employee turnover rate of 78%, several failed attempts at major application development, and an irate and dwindling user community.

The turnaround of the computer center started with a change in our basic management philosophy. A primary tool we found to initiate and maintain a more effective management philosophy is the management retreat. The purpose of this session is to present the positive management philosophy of our computer center (whose primary mission is administrative data processing) with particular emphasis on our management retreats.

Overview of Management Philosophy

The mission of a computer center is, obviously, to provide computing services to its user community--whether administrative, academic, or a combination of the two. The goal of all computer centers should be to provide their user communities with excellent service at a reasonable cost. In order to know if you're reaching that goal, a computer center needs to agree on a definition of excellent service. Our definition is: "Excellent service is whatever the receiver of the service perceives excellent service to be." The premise underlying successful completion of our goal is: "The perception of our users is not just important, it is everything!" The objective of TUCC management is to create a positive environment in which the staff's attitude reflects a commitment to delivering excellent service to our users.

An organization with such an attitude will likely demonstrate the following characteristics:

1. Network Organization (vs. Hierarchical)
2. Teammanship
3. High Levels of Communication
4. Ideas Encouraged Intensely
5. Direction towards Service

Tl irst four characteristics (network, teammanship, communication, and idea encouragement) describe the desired inter-personal working relationship of the staff. Such an environment, when cultivated by the director, will propagate throughout the organization. These positive qualities are spread through:

1. Encouragement of individual thought
2. Freedom to speak one's ideas
3. Minimization of rank in the exchange of ideas
4. Respect for the competence of one's peers, bosses, and subordinates
5. Respect for one's own competence
6. A positive problem solving attitude

I contend that once you instill these ideas within your staff, your group cannot help but be service directed.

Additionally, instilling these attitudes will not only increase the value of each individual within your organization, it will facilitate group effectiveness. Group effectiveness is a function of conflict, creativity, competence, and commitment. Full scale involvement by group members causes divergent ideas and values to surface. Conflict can initiate creativity. Only when individuals become aware that their opinions differ from those of others are they likely to reexamine their own personal assumptions and intuitively recognize a need for more information. This reassessment process forces new insights to emerge. It is a self-feeding process. The ideas that come from such action have the compelling quality of logical consensus, plus they spar ther creativity. Commitment is a psychological state and cannot be achi through coercion, persuasion, or directive. Dedication is self generated and is strengthened through an individual's participation within the group.

I am assuming that by now I have sold all of you on the value of creating a dynamic and dedicated environment. After all, the objective of management is to get things done through people. This is done best when the whole person is utilized (intellect as well as labor), and the person is committed to the task at hand.

Positive Administration Techniques

An organization needs establish only two premises to begin the creation of a positive environment. The first is accountability--that is the acceptance of responsibility by each individual for meeting the goal of the computer center. The second is an understanding of and a commitment to positive problem solving. Both of these qualities can be achieved more easily than you might imagine. The important thing is to consistently emphasize these two principles.

Determining the accountability attitude of your group can be done with a simple test. Gather your staff together to discuss current topics of

concern. Listen carefully to the pronouns they use during the discussion. Which word do they use most frequently?

They
We
I/You

For example, which statement would you be most likely to hear in a meeting of your staff members?

<u>They</u> have decided that the programming standards should be reviewed.
<u>We</u> have decided that the programming standards should be reviewed.
<u>I</u> have decided that the programming standards should be reviewed.

The use of the word "they" implies distance between the speaker and his subject. Whatever is being said, It means:

The issue is out of my/our control.
I/we are not responsible for the result.

Use of the word "we" implies:

It is in our control.
I/we are responsible for the result.

Note: Use of the words "I" and "you" not only define areas of responsibility, they often imply that the speaker feels the issue deserves immediate attention.

Encourage your staff to become aware of the subtleties in the difference. Insist they listen to themselves and others. Every time someone says "they," invite the group to confront the speaker with the question, "Who is They?" The idea is for the staff (from the student assistants to yourself) to talk and think with "we's," "you's," and "I's" in any discussion involving computer center operation, mission, or service.

The other crucial attitude is positive problem solving. Positive problem solving is the act of directing resources (thought and action) towards how a problem can be solved or how a task can be accomplished. It can be contrasted against negative problem solving (what most people actually do) which is directing energy towards itemizing reasons why a problem should not or cannot be solved. This might also be called solution avoidance. I am constantly amazed at how much negative problem solving I hear in some organizations. Imagine, many companies spend millions of dollars on personnel services supposed to solve problems and accomplish tasks, but what they get for their money is a list of reasons why the problems and tasks could/should not be solved or accomplished. It turns out to be an absolute waste of resources. Positive problem solving and negative problem solving require the same amount of energy. Why don't we opt for the positive approach and accomplish something with our resources? In addition to getting the work done, you and your staff will start finding your jobs and environment a lot more rewarding. This can only result in increased morale.

The first step in making positive problem solving a part of your organization's management strategy is to begin practicing it yourself. The second step is to teach your staff about it. The third step is to translate any negative problem solving that you find into the positive approach.

Once we begin practicing basic positive thinking and behavior, it's time to go on the first management retreat. Retreats can be held for any group in an organization but the first one should be for the managers. They are the crucial group to indoctrinate with the new management philosophy. Then you may consider working with other groups as you see the need to do so.

Getting Ready for the Retreat

You will need to plan for the retreat to last 2½ to 3 days. Pick a quiet relaxing place away from campus. State parks usually offer such facilities. Perhaps, a lodge in the mountains, on a lake, or at the seaside might be available. Selecting a setting away from the usual atmosphere is more important than the specific facilities provided. For example, it is not necessary that restaurants be available. I have found that it is really easier to cook your own food than to descend on a restaurant. However, it takes a little extra planning to do this. Delegate someone to handle menu preparation--who and what's cooking for each meal. Make sure everything is understood before leaving in order to avoid confusion. Meal cooking in groups offers excellent opportunity to build team skills.

Begin a series of communications with the selected attendees about two to three weeks prior to the retreat. This correspondence serves several purposes. It makes people feel involved with the planning process, lets them know what sort of experience they're in for, and it stimulates them to begin thinking about universal problems rather than day-to-day operational problems. The success of the retreat can be greatly enhanced if your attendees come prepared with some issues that they have determined to be of importance.

Your first correspondence should include a statement of direction which will lead the retreat discussions. Examples of statements of direction which TUCC has used are:

> The technologies of computing and communications increasingly overlap. To maximize the benefits of new technological offerings, "technocrats" from both areas should likewise overlap their expertise, forming new task forces who exploit the opportunities in the blurred lines of separation. During FY 88/89, The University Computer Center and Communications Services will position themselves for the installation of the new voice/data switch targeted for December 1989, by identifying new service made available by the new switch and overlapping technologies, and identifying task forces of "technocrats" to investigate the new opportunities.

> During FY 86/87 The University Computer Center will do more with fewer people and dollars while keeping morale high.

During FY 84/85 TUCC will devote considerable resources toward increasing the value of data found at TUCC by making that Institutional Data more available to end user departments. More specifically TUCC will utilize new technological developments in the areas of:
Protocol converters
Personal computers
The Information Center,
or
Horses, like trends, are easier to ride in the direction they are going.

Of course, the initial correspondence should also include the specific retreat dates and location (remind attendees to make sure that their absences are covered). It should be stated that dress will be comfortable and casual.

A few days later, prepare a second communication defining the management retreat purpose. The management retreat purpose is:

To develop a specific plan of action which will support the Statement of Direction for the year

and

To enhance communication and understanding among computer center personnel

This memorandum should also include a statement of the general rules which will govern the retreat.

General Rules for Participants

1. All energy resources will be directed toward how we can accomplish the agreed upon objectives. Conversation or thoughts directed towards why objectives should or could not be accomplished are taboo. The session chairman will strike negative problem solving comments.

2. All participants are equal. There is no management rank in planning sessions.

3. Participants cannot "put down" another participant's thoughts. However, any participant can add to an existing thought.

Your third and final correspondence (see how you're beginning to "psych everyone up" about the upcoming retreat) should include a set of thought provoking questions. Some examples are:

1. Are you an effective manager? Do you feel that you are effectively managed?
2. Do you think your abilities are trusted? Do you trust the abilities of your co-workers?
3. Would you rather work someplace else? Why or why not?

4. Are you proud of your accomplishments?
5. Do you think you are given adequate information and resources to do your job? Do you give your staff adequate information and resources to do their jobs?
6. Do your users view you as a resource or an obstacle?
7. Do your users have to manage your managing to provide them what they need in a timely manner?
8. Which do you think is more important to Delta Airlines--their passenger reservation applications system or their terminal network to access the reservation system?

Planning Process and Agenda

This final preparatory correspondence should include a description of the functional process to be used at the retreat. Your retreat schedule should be structured along the following lines:

1. Discuss and agree upon gross objectives to be met within the statement of direction. Provide these objectives.
2 Identify the problems that must be solved associated with each objective. Problems must be stated in complete sentences, i.e., because . . . , therefore . . . . OR condition/cause--result/effect.
   Note: no discussion of possible solutions will be allowed during problem identification.
3. Prioritize the problems identified.
4. Discuss possible solutions for each problem. It may well turn out that the solution for one problem may also serve as a solution for another problem.
5. Prioritize the solutions.
6. Roll out an action plan from the solution identification. Each action plan should include a person or group responsible for completing or implementing and a target date.

Naturally, the gross objectives help guide the problem identification, solution identification, and prioritization process. They need to be stated in a simple and direct manner. Examples of past TUCC retreat gross objectives are:

1. Set up facilities to help users (and staff) acquire and use new technology
2. Encourage the use of P.C.'s in the development of administrative applications
3. Create and maintain a central repository of documentation about university data (Information about information for your information)
4. Increase the productivity of TUCC
5. Improve our effectiveness/trust with the user community
6. Set up guidelines for an office automation network
7. Implement ACF2 in an orderly fashion
8. Reduce risk in application support due to employee turnover

The last communication should also include a copy of the agenda. In planning your agenda, allow twice as much time for problem identification as you do for solutions. They are much more difficult to identify and state

succinctly. You will, of course, want to consider providing free time in the middle of the day for attendees to enjoy the surroundings. This time can always be made up in an evening session. In fact, discussions often continue long into the night under their own steam; folks really can get into this.

Sample Agenda

WEDNESDAY

I. Leave Computer Center for Calloway Gardens at 8:00 a.m. Wednesday, August 28, 1985. Check in, lunch.

II. 2:00 - 3:00
Review of planning methodology and opening remarks
Session Leader: Director

III. 3:00 - 4:00
Identification of Objectives
Session Leader: Jeanne

IV. 4:00 - 6:00
Problem Identification
Session Leader: Bob

V. 6:00 - ?
Cookout

THURSDAY

I. 8:00 - 10:00
Problem identification Continued
Session Leader: Bob

And so forth

I believe you get the point. Your specific times and events will depend on your personal arrangements.

Additional Retreat Guidelines

The first hour or two belongs to the director. This is the only time the director should take a leadership role in the retreat. However, this time is extremely important in setting the mood for the retreat. A relaxed and positive attitude needs to be established immediately.

On your first retreat, you will probably want to devote the initial director's session to talking about the process the retreat will follow. Since we do this every year, definition of the retreat process doesn't require all that time. Therefore, I take this time to present subjects such as:

1. Reviewing the key issues in a currently successful management study. I have done "book-reports" on In Search of Excellence, Megatrends, The One Minute Manager, and similar publications.

2. Talking about the effective management techniques we have discussed earlier (positive problem solving, commitment to excellence, group effectiveness, and so forth).

3. Discussing the priorities managers should use in decision making, such as: What's best for UAB? What's best for the department? What's best for the individual?

Each session should have a chairperson whose responsibilities are to assure that only positive problem solving is used. He must never allow anyone to put down another's ideas. For example, someone offers a solution to one of the specific problems identified in an earlier session and another attendee pipes up with, "that won't work because . . . ." The session chairperson should instruct the piper-upper to replace the objection with an acceptably stated problem defining the additional situation to be solved. The session chairperson is also responsible for taking notes of the session's activities. We have found that recording these notes on large flipcharts is the most effective technique.

Post-Retreat Synthesis

Over the past eight years, since our first experiment, I have taken groups on at least a dozen retreats. Never, in all those times, have we ever completed all that we wanted to do. Therefore, much organizing of ideas, task lists, priorities, problems and solutions (all the things that were talked about at the retreat) must be done after returning to the work place. When you get back to the office, you need to prepare a report consolidating your retreat accomplishments. It should include task lists, action plans, specific individual responsibilities, and target dates. These goals should be reviewed in your regular staff meetings, on a monthly basis, to monitor progress and keep the retreat objectives visible. Your written report should include specific statements of the proposed problem solutions. Add your personal comments pertinent to the various sessions. This report should be distributed throughout the entire computer center for review. Publishing your results makes everyone realize that their problems are being addressed, and it educates them in the retreat methods. This helps ensure that future attendees are acquainted with what the retreats are all about.

Conclusion

At the risk of undercutting all the enthusiasm I have tried to generate for the retreat process that we have found so successful, let me make your aware of the one major risk that I see with this system. Management retreats are a motivator. However, I have a story I tell at the end of each management retreat. It goes like this:

The XYZ firm is a small company of approximately 100 employees. This firm manufactures widgets. The President, Ms. Jolly, struggled for many years

anaging the firm, just barely showing a profit. One year she encouraged everyone to work especially hard, and, indeed, the company showed a greater profit that year. Ms. Jolly was most grateful and appreciative of her staff's hard work, and she wanted to do something to demonstrate her appreciation. She decided to give everyone a turkey for Christmas. All the employees were most thankful for those turkeys and appreciative of her thoughtfulness. Next year, close to Christmas, some of the employees started asking Ms. Jolly if they were going to get a turkey for Christmas again. Ms. Jolly felt obligated to repeat this gesture, and so, once again, she gave them turkeys for Christmas. The following year some of the employees pointed out to Ms. Jolly that their turkeys were a little smaller than the others--still other people indicated that they preferred ham to turkey, and another group asked if they could have cash instead.

The moral of this story is that motivators can turn into demotivators. This story is well known in our computer center. Frequently, the comment, "Sounds like turkeys for Christmas to me,' can be heard from somewhere down the hall. The point in circulating this story is to keep your staff aware of the motivation/demotivation pitfall and provide a communication tool to confront it when it starts to surface.

A recent Fortune magazine cover article, "The Winning Organization," makes several points which underscore the positive management philosophy being presented. The article states that the hierarchical structure adopted by business nearly a century ago (a system, incidentally, copied from the military) will fade. With the help of information technology, managers can increase the number of people reporting to them by several orders of magnitude. Hence the minimalization of rank, both in importance and actuality, facilitates a leaner payroll and a more idea intensive organization. Shouldn't we computer center directors be the first to realize within our own staffs the business benefits of information technology, the very technology we deliver?

Moreover, most all the baby-boom generation now hold jobs. Growth of the work force will slow down significantly--from 2.4% a year in the Eighties to 1.2% in the Nineties. The Bureau of Labor statistics estimate that the number of jobs will begin to grow faster than the labor force. Companies will have to offer new inducements, especially to women, who will make up two-thirds of the new workers, to continue to attract employees.

A current buzzword in employee motivation is "ownership." This can mean either an equity share of the organization or just a worker's feeling that he counts. Fortune quotes Harvard Business School professor J. Richard Hachman; "If you want me to care, then I want to be treated like an owner and have some real voice in where we're going." That is exactly what happens at TUCC with the management retreats; it is a true win-win scenario. Employees care because they have a voice; management reaches better decisions because the employees have that voice.

In summary, while preparing this talk, I reread a memorandum I wrote to the staff after the 1984 retreat. It expresses my feelings very well.

"Enclosed is a summarization of the objectives defined, problems identified, and solutions suggested as the result of the TUCC Spring '84 Management Retreat. From my personal viewpoint, and that expressed to me by others, this was the most productive retreat we have had. The retreat was in itself a solution to many of the problems identified. It was instrumental in providing a forum in which we all became more aware of TUCC happenings and internal TUCC communications needs. Teamwenship reached an all time high. An environment was facilitated that resulted in feelings of personal motivation, which I am convinced will be contagious and increase the productivity of the entire staff.

It is interesting to note that almost all group attendees expressed their observation that the retreat brought to their attention the progress we have made at TUCC. This is in itself rewarding. Although difficult to express in words, this retreat had an air of forward movement with few existing central problems. In contrast, the last retreat had been more directed at surviving the state of affairs. I was and am overwhelmed by and proud of this center's productivity. This retreat demonstrated the sincere desire for each attendee to make TUCC more valuable to UAB and a better place to work for all of us."

I have never failed to return from a retreat drained and yet satisfied. I am convinced that the techniques we have discussed will improve the operating effectiveness and morale of any computer center willing to make the small investment it takes to get the process begun. I encourage all of you to consider a positive management philosophy and the retreat process as vehicles to bring increased excellence to your organizations. It works for us.

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DATA ADMINISTRATION:
What is It, Where is It, How is it Done?

Panelists

Dr. Karen L. Miselis
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Dr. Lawrence A. Jordan
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Los Angeles, California

Mr. Ronald Hoover
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Moderator

Dr. Gerald W. McLaughlin
Associate Director
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Overview

Today we are going to try to help define data administration in higher education by presenting to you three models in different stages of development in three different universities. Each of our three speakers will describe data adminisitration in the following format. They will first present the history of the development of data administration at their own institution. They will then explain how data administration fits into their institution in an organizational sense. Finally, they will explain the nature of their own responsibilities, authority and level of institutional support from their perspective as data administrator. We hope to save some time at the end of our panel presentation for discussion of such issues as the reasons why data administration is differently defined in different universities, the political and finanacial considerations of data administration, awareness of information as a critical institutional resource, and the difficulties of managing the data administration function.

We all agreed that the responsbilities of data administration can be organized in several broad categories. Each speaker will explain to you his or her responsibilities in the following eight areas: information systems planning, data administration policy, the data dictionary, support of institutional research and planning, institutional awareness of information as a critical institutional resource, security and access, training and documentation, and data integrity. You will see that there are significant differences in the role of each data administrator based to a great extent on the culture and organization of the partiuclar institution and its stage of development of information resource management.

University of Pennsylvania

History of Information Resource Management and Data Administration

The University of Pennsylvania began to do planning and thus require management information to support planning as early as 1974. While it became clear almost immediately that the institution's information systems were not adequate for the task, the solution to the problem was not clear.

It was not until the appointment of the Vice Provost for Computing in August 1984, that Penn's computing and information resources were centralized under one leader. While the major reason for the creation of the new position had been to lay down the technological infrastructure for both academic and administrative computing across campus, it quickly became clear that the University's information systems needed significant revision to support the complex planning and management taking place at Penn. At the same time that he devoted resources to the implementation of a campus network, David Stonehill began to develop new information systems within the context of a discussion of information as a critical strategic resource of the University.

That discussion culminated in an important evaluation and planning effort undertaken in June 1987. The resulting document, the Strategic Information Resource Management Plan, published in November 1987, noted the shortcomings in Penn's information systems and recommended a number of changes. Two of the most important recommendations were that Penn organize and maintain closer connections between institutional strategic planning and information systems planning and that there be established an Office of Data Administration and Information Resource Planning.

I was appointed in June 1988. We moved forward with a forceful internal planning process within the Office of the Vice Provost, continued to establish some of the structures and plans recommended in the 1987 document, and recommended further steps in the Information Resource Management Plan submitted to the senior management in October 1988. Effective information resource management at Penn requires major changes in the way that the University has functioned up to now. One of the most important tasks of Data Administration is to support a successful acculturation process in this regard.

Penn's Organizational Structure for Information Resource Management

Penn's information structure has developed over time and is not centralized into one organizational unit. The Offices of Planning and Institutional Analysis and Budget and Resource Planning supply information for strategic planning and decision support to the Provost and Senior Vice President through a variety of reports and research projects. At least half of the twelve schools and many of the centralized functional offices within the University perform their own institutional analysis in a s well. The data base supporting virtually all of this information retrieval and analysis is that of the centralized University Information Systems. The Office of Data Administration is responsible for the planning, maintenance and distribution of all University information in those information systems.

Data Administration reports to the Vice Provost for Computing, Penn's designated chief information officer. University Management Information Systems (UMIS) is responsible for the technical support of the data base, application development, and maintenance of current systems. Data Administration works closely with UMIS in the planning, design and development of new information systems and in the development and enforcement of policies concerning the data dictionary, security, access, system integration and data integrity.

In addition, Data Administration works with a broad circle of information resource managers across the campus to plan new systems and to serve the most pressing University needs in information support. A major portion of our most recent proposal on information resource management involved the development of a new campus-wide committee structure to support the planning of a University data architecture and development of information resource management throughout the University. That committee structure then relates very closely to a newly

defined program and project management structure for the planning, design, and development of new information systems. Each major information system within the University has a custodian responsible for its integrity. That custodian is usually the centralized functional office responsible for the related administrative activities. For example, the Office if the Vice President for Human Resources is the custodian of the data elements in the Personnel/Payroll system. As custodian, that office is responsible for enforcing the policies and standards written by Data Administration.

Data Administration Responsibilities, Authority, and Support

Data Administration is responsible for organizing and supporting information systems planning on a variety of levels. At the highest level, Data Administration provides staff support to the Senior Advisory Group. That groups recommends all priorities in information systems development to the Provost and Senior Vice President. The University Data Administrator chairs the Information Resource Managers Group that meets regularly and provides information and advice to the Senior Advisory Group. Data Administration will also be one of the driving forces on the ad hoc Planning Task Forces established to plan and design new information systems.

The University Data Administrator is responsible for developing, getting approved by senior management, and implementing a wide variety of policies and standards; including those on the design of an institutional data architecture, on the planning of new information systems, on the use of the University data dictionary, on security and access within the University information systems, and on the training and documentation involved in all University information systems.

We are currently establishing the policies and standards for the data dictionary by actually writing the data dictionary for a new student record system to be installed in September, 1989. We are establishing policies not only for the definition of each data element, but also for the entire structure and content of the data dictionary. For example, we will establish that each system and each file must be defined in the data dictionary, that the data dictionary must contain information on which programs use which data elements, and that the data dictionary connect redundant data elements between systems. Most importantly, we must establish the methods by which the data dictionary will be maintained in order to assure its accuracy and usefulness to the community.

In order to support the crucial institutional research function of the University, Data Administration is designing and implementing a separate Management Data Base that will be used solely for ad hoc query by authorized members of the University community. This data base will contain relevant information obtained through the University's operational systems and will offer easy access to users, appropriate security, and user support in the form of a manual for Institutional Research at Penn as well as personal consulting.

Institutional awareness of information as a critical University resource is relatively high at Penn, principally because of the strong support provided by the Provost and the Senior Vice President. Data Administration will extend that awareness through the committee structure, through organized retreats and seminars, and through personal contacts in the schools and departments across campus.

To be effective, the policies for data security and access for so many complex systems must include the description of structures to be used in the administration of security policies, placing a great deal of responsibility in the hands of the custodians of the various systems. The University Data Administrator must have the authority to approve that administration and resolve any disputes regarding security.

Data Administration has the authority and responsibility to ensure the provision of proper documentation, training, and support for all authorized users of University information systems for both operational and analytic activities. The responsibility for the actual provision of the training is shared between the computing resource center and the centralized functional office that is custodian of the particular information system.

Data Administration has the authority and responsibility to ensure that all new information systems are designed to be integrated with existing systems and to improve integration within already existing systems with the long term goal of a completely integrated information base.

Conclusion

It is clear from our time frame that our work at Penn in data administration has just begun and remains to be tested in many areas. We believe that we have reason for optimism, however, because of the very high level of support by senior management as well as the general belief across campus in the need to improve data accuracy, integrity, timeliness, and access. We hope to report a high level of success at this time next year.

Data Administration Within an Information Resources Management Organization

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Panel Presentation: CAUSE88, Nashville, TN.
Data Administration: What Is It, Where Is It, How is It Done? November 30, 1988

Development of data administration at Cal State L.A.

I have titled my talk, "Data Administration Within an Information Resources Management Organization" because I want to emphasize the fact that information and the management of information resources are the primary organizational concepts at Cal State L.A., and that data and the data administration or management of data fall within it: It is the information infrastructure that is being installed at Cal State L.A. that will make it possible to administer the data.

California State University at Los Angeles is one of the 19 campuses of the California State University System. It is a comprehensive, large, urban, multi-ethnic university. It has 21,000 students, of whom 25% are Asian, 25% are Latino, 25% are white non-Hispanic, and 25% are everything else. About 30 percent of our students are graduate students. Over half of our students are attending part time, and over 40 percent of our classes are offered after 4:00 PM. or on Saturdays.

Before there was Data Administration (DA) at Cal State L.A., there was Information Resources Management (IRM), and before IRM, there was Data Processing (DP). We skipped right over Management Information Systems (MIS). In the early 80's, DP operated a diverse collection of computer programs, some of them designed originally to take advantage of the very latest in IBM keypunch card technology, and adapted to read and write 80-column card images to and from tape. It was not a pretty sight. While other institutions were in the vanguard of administrative computing, we were left back in the van.

Major changes began in 1985. Our President, Dr. James M. Rosser, had appointed a blue ribbon committee to study the state of information technology at the University, and this committee concluded that it was not state of the art. One major recommendation of the committee was that the University appoint a Chief Information Officer, a Computer Guru, a Technological Wizard capable of brewing powerful computing potions out of bat wings, newt eyes, chicken entrails, and very little budget. In short, we needed a Vice President for Information Resources Management. Dr. James I. Penrod applied for the job, rolled up his sleeves, and started to work in September of 1985.

A key breakthrough in bringing Cal State L.A. into the 20th century was an innovative research and development project between IBM as the hardware vendor, Information Associates (IA) as the software vendor, and three campuses of the Cal State University. The first part of the project involved installing a new IBM administrative mainframe, and converting our existing student data systems into IA's Student Information System. The second part of the project--the R&D part--involves converting the existing software, which is implemented under VSAM, into IBM's DB2 relational DBMS environment. What IBM and IA get out of this arrangement is the first full-featured student information system that will run in DB2, with Cal State L.A. and the other two CSU campuses as test sites. What the campuses get out of the arrangement is a state-of-the-art student information system, hardware to run it on, superb technical support for the term of the R&D project, and substantial price breaks that have made it possible for us to afford these things.

We have just completed the first year of the project, and have essentially completed installation of the VSAM version of the software--a project that IA recommended that we complete in about 18 months, but which we completed in a rather exciting, challenging, and hectic 12 month period.

Placement of the data administration function within the institution

At Cal State L.A., IRM has two main wings, an academic wing (Academic Information Services) and an administrative wing (Operations), each under an Assistant Vice President. The administrative wing has most of the staff, and operates all of the hardware, including the phone system. (I didn't mention that we installed a new digital switch and a cabling system with a fiber optic backbone last year, in our spare time, to provide the communications network for tying all of our computer systems together.)

Data administration, analytical studies, and institutional research are in a single office on the academic side of IRM, and there is a single professional occupying all three boxes at present. I am that person. This, however, is a temporary arrangement while we are devoting so much of IRM resources to the installation of the new student information system.

Placement of data administration on the academic side of IRM, grouped with institutional research and analytical studies, implies a couple of things. First of all, our main clientele consists of the president and vice presidents, but especially the Vice Presidents for Academic and Student Affairs. Formerly, we had an office of institutional research (IR) that reported to the Vice President for Academic Affairs. With the reorganization of IRM, the IR office was moved over to IRM and the concept of the office was broadened to include analytical studies and data administration. The old-fashioned notion of IR is that it passively monitors institutional data as they fly by--sort of like reading a ticker tape ("Gosh, 200 blocks of IBM traded, up 3/4 of a point. I wonder what that means?". Nobody I know does IR that way, but you know what I mean.) "Analytical studies" implies a kind of proactive IR, so that we attempt to reach out and conduct special studies or analyses to determine what it all means. "Data administration" implies that there is a central oversight of all the data, and that it is aggressively managed to be non-redundant and cohe it, with integrity and justice for all. Despite : move to IRM, the analytical studies office still has close ties with the Vice President for Aca nic Affairs. We currently emphasize research dealing with program evaluation, retention studies, enrollment management, and academic resource management.

A second implication of the fact that DA is on the academic side of IRM is that we re not part of database administration, programming, or operations. As our database administrator puts it, there is a "creative tension" between his office and mine, where we each have slightly different aims, different views of the data, and different territories to protect. The DBA and I have a regular weekly meeting to iron out some of these differences and coordinate our activities during installation of the student information system. As DA, I am not totally dependent on the programming staff for analyses of university data and can conduct independent ad hoc analyses. This provides a kind of check and balance system, so that I can verify the work of programmers. This aspect of the office relies partly on my own training, as a social scientist with a strong interest in statistical computing. I am very comfortable with writing programs to analyze mainframe data, and downloading results of the mainframe analyses into microcomputers for refinements and graphing. I informally audit institutional data for consistency, making sure that none of our first time freshmen are in graduate school, that students are not earning degrees in Undeclared Major, and that the trend shifts we observe are the result of actual demographic changes in our student population, and not merely a function of the fact that a programmer created a bug somewhere or unexpectedly found and removed one. (The DA will establish a formal auditing function, once our data systems are in place and the conversion effort is not consuming so much of IRM's manpower resources.)

Responsibilities, authority, and support of data administration

IRM at Cal State L.A. is an organization in transition. There is much work to do, and it has to be done in phases. As a result, data administration is not as far along as I would like it to be. For the last year, I have been spending at least half of my time on the new student information system project, particularly focussing on data definition and data conversion issues. The OASIS project is managed from a policy perspective by a series of interlocking task forces, which have been quite active and very useful in getting key players talking to one another on a regular basis. (It is ironic, in a way, that the University sought a CIO who would "tell us how to do computing," but one of the main things that he has accomplished is to get us talking to one another. One of his themes is that IRM is not just a new organizational structure that gets grafted onto the university, to conduct old-fashioned business on a bunch of fancy new electronic boxes. Rather, IRM entails wholly new ways of doing business, in which the person-to-person communication must occur more rapidly and fluently than ever before. E-Mail and voice message forwarding are not just cute new ways of doing things that we've always been doing, they allow more efficient and effective communication and decision-making to occur. The media are indeed the message.)

IRM was not built in a day. Now that the student information system is falling into place, it is useful to look more formally at the responsibilities and role of data administration. It is refreshing to be able to look above the data processing trees and talk a little about the shape of the forest. As agreed with the other panelists, I will write about data administration at Cal State L.A. under eight headings:

1. Information systems planning and data architecture design
2. Data administration policy development and approval
3. Data dictionary and encyclopedia
4. Support of institutional research and planning
5. Institutional awareness of information as a critical resource
6. Security and access
7. Training and documentation
8. Data/system integration and data integrity

Information systems planning and data architecture design. My office did not participate in the selection of the hardware and software, but we are clearly beneficiaries of it. One of the main guiding principles in selecting the IA software was that it be an off-the-shelf product with a rational architecture, and not one that we would have to write ourselves or extensively modify.

As the IA system has been installed, however, it has become clear that it is primarily an operational system, with a database designed to support the day-to-day operations of the University. It provides some limited tools for analysis and reporting, but they do not support systematic longitudinal and cross-sectional studies, which are the mainstay of institutional research. Operational and analysis databases have somewhat contradictory hardware and software requirements. Operational databases should be optimized for transaction processing and random-access I/O, while analysis databases should be optimized for number-crunching and sequential I/O. Operational databases are constantly in flux as new data become available and supersede the old. For analytical purposes, however, we need to "freeze" the data at discrete intervals to produce summaries as of the "census date" that occurs each quarter. Having the same system satisfy both operational and analysis needs is a little like trying to have a roomy family sedan that gets excellent gas mileage and accelerates 0 to 60 in 60 seconds.

Over the next year, a major project of the DA will be designing systematic abstracts of the operational database to serve as an analysis database. Another project will be design of a planning database and testing an Executive Support System designed to run with IA mainframe software and selected microcomputer hardware and software. (The specific project, which is funded in part by a grant from Apple Computer, Inc., involves testing the microcomputer side of the ESS on a Macintosh II.)

Data administration policy development and approval. My office develops data administration policy for recommendation to the Vice President for Information Resources Management. Data administration is one element in the IRM strategic and tactical plans.

Data dictionary and encyclopedia. A strong feature of the IA software is an integrated, on-line data dictionary. A user of the student information system can instantly retrieve up parts of the database definition (DBD) pertaining to each data element on every screen, and can also get information by topic or by keying in the data element number. The DBD is also used by the system to validate data values during input and to determine data formats for I/O. DBD entries and changes are initiated by data owners, who are usually in user departments. They are approved by the DA, who reviews them for consistency with other data elements, and by the database administrator, who is responsible for their technical implementation.

Support of institutional research and planning. My office does IR, and we support ourselves as best we can. We have primary responsibility for ensuring the accuracy of data reported to external agencies. Planning is a major personal and professional interest of Jim Penrod. He and the Provost for Academic Affairs coordinate the planning effort for the University, and Analytical Studies often does special studies and analyses in support of planning. Eventually, we want to identify key strategic indicators of the health of the institution--checking the institutional pulse, as it were--so that we can maintain and improve the levels of these indicators.

Institutional awareness of information as a critical resource. There is much awareness of information as a critical resource at the University, but also a belief that information cannot be made available when it is needed. We need to deliver.

Security and access. Physical and logical data security and access are largely controlled by the manager of computer center operations and the data base administrator. As DA, I have inquiry access to all of the University's data. Eventually, the DA will develop procedures for formally auditing the University's computerized data systems.

Training and documentation. Training and documentation are provided mostly by the administrative side of IRM, under the direction of a training coordinator. Documentation of the data elements in the data base dictionary is available on line.

Data/system integration and data integrity. Data/system integration and data integrity are greatly helped by having the IA software. Beginning in January, we will start installing IA's Financial Record System, and in late 1989 will install their Alumni and Development System. Their Human Resources System may also be installed. All four systems have a common look and feel, and ride on top of an integrated database dictionary and data access tools.

Data integrity is made feasible by having a rational database management system that minimizes data redundancy and duplication. However, ensuring integrity is a constant struggle. It begins with quality control of data entry operations, depends on careful and well-documented programming and system development efforts, and requires constant checking and re-checking of data for consistency with past data and screening for wild values and incompatible data combinations. My office is very much involved in testing each quarter's data for consistency and in bringing potential data problems to the attention of the user areas and programming staff.

Thus, we are currently working toward an environment having all of the main administrative data resident within an integrated system on a single mainframe. This has built-in advantages for data integrity. As but as we move to a networked environment, with data and processing occurring on more than one mainframe, data integrity will become more of an issue again. We will also have an analysis database representing census-date information, to complement the operational database. Maintaining data integrity in the analysis database and referential consistency with the operational database will be a major concern of data administration as the analysis database evolves.

Data Administration
at
The Pennsylvania State University

HISTORY

Data administration in the form or policies, procedures and security measures has existed at Penn State for a long time. In 1971 a data management group was formed within the central administrative data processing area to address data management issues from a systems and hardware point of view. With the acquisition of the first major database management system, IMS, in 1974, the data management group evolved into database administration and assumed more responsibilities in the area of data definition, protection and efficient data utilization. The acquisition of the ADABAS database management system and the development of major student systems in 1982 through 1985 created an environment in which more data was available to more users than ever before. This environment led to the creation of a formal data administration function in 1986. The objectives of the function are to manage data as an institutional resource in an accurate, complete, accessible and secure manner. Data administration at Penn State is not empowered in a single person or organization; rather, all units interacting with the system share the responsibilities.

ORGANIZATION

The data administration managerial role is assigned to the Manager of Data Administration in the Information Resource Management group of the central administrative data processing organization called Management Services. The director of Management Services reports to the Executive Director of Computer and Information Systems who in turn reports to the Provost of the University.

The Manager of Data Administration has responsibility for both data administration and database administration functions, and oversees a staff of seven people.

RESPONSIBILITIES OF THE MANAGER OF DATA ADMINISTRATION

1. Information Systems Planning/Data Architecture Design

   The manager is responsible for the design, implementation, and management of physical databases within the administrative data processing area and for coordinating database development or conversion plans with other administrative units.

2. Data Administration Policy Development and Approval

   Develop policies, standards, and procedures to be considered and approved by University executives for the administration of computerized institutional data.

3. Data Dictionary/Encyclopedia

   Responsible for the development, population and maintenance of the data dictionary and for the creation of standards and procedures to access and use the dictionary.

4. Support of Institutional Research/Planning

   Data administration supports institutional research/planning through the coordination of requests for access to institutional data and the identification and definition of data and system resources.

5. Institutional Awareness of Information as a Critical Resource

With the establishment of a data administration function in 1986 the University recognized the importance of information as a valuable resource that must be carefully planned for and managed. The awareness of information as a critical resource has been further enhanced with the creation of official university policies on data security and privacy and the use of computerized institutional data. These policies establish measures for the protection and use of information and must be read and understood by all users of institutional data.

6. Security and Access

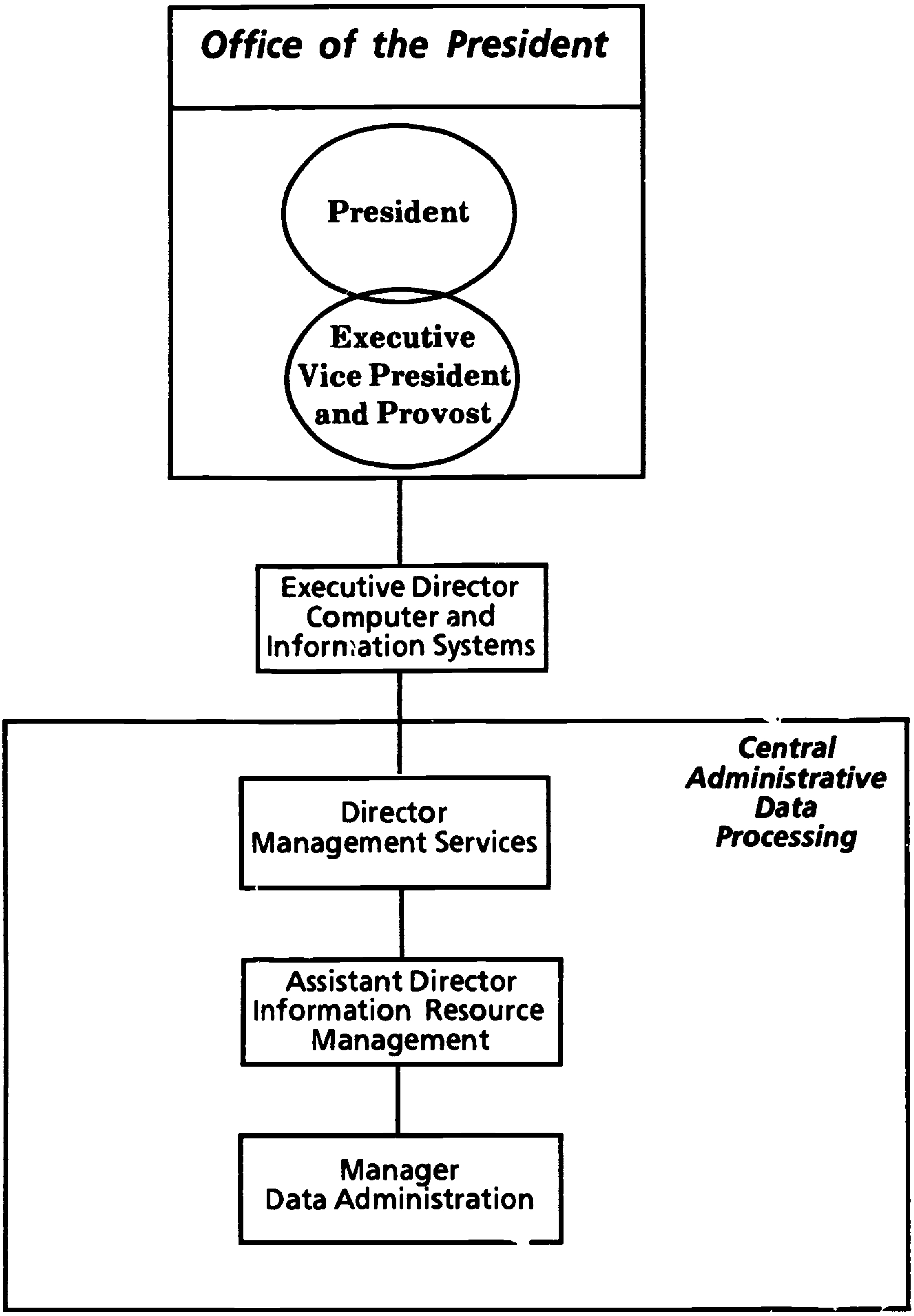
In conjunction with data stewards and other organized administrative groups, data administration develops guidelines for user access to data and processes requests for access to institutional data. The database administration section of the data administration group maintains most of the software used to implement security in the database systems. A separate group within Information Resource Management is responsible for the administration of the security systems.

7. Training and Documentation

Oversee training and communications regarding data administration and provide documentation on university data and the procedures for gaining access to and using data. Documentation is provided in the form of printed documents and online screens.

8. Data/System Integration and Data Integrity

Responsible for assessing the impact of the addition of data and systems into the existing database and for authorizing their final implementation. Through the database administration function, insure sound standards are applied to insure the integrity of the data in the university databases.


Office of the President
President
Executive Vice President and Provost
Executive Director Computer and Information Systems
Central Administrative Data Processing
Director Management Services
Assistant Director Information Resource Management
Manager Data Administration

THE DEPARTMENTAL PLANNING TEAM: A BRIDGE TO THE FUTURE

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ABSTRACT

When the Information Technology Division was created in 1984 it brought under one reporting line both the Academic Computing Center and the Office of Administrative Systems, two large organizations with radically different missions and organizational styles. The two organizations remain distinct entities, but have undertaken a number of joint ventures and have made conscious efforts to improve coordination of their services and activities.

One of the primary vehicles for coordinating services to faculty and staff has been the Departmental Planning Team, a joint effort of the OAS Information Center and Computing Center User Services. This paper describes the evolution of this group and its activities since the fall of 1986, analyzes the factors contributing to its success, identifies challenges and issues, and discusses the outlook for the future.

THE DEPARTMENTAL PLANNING TEAM: A BRIDGE TO THE FUTURE

I. Why the Departmental Planning Team (DPT) was Created

In 1984, the creation of Information Technology Division (ITD) drew together the academic Computing Center, the non-academic Office of Administrative Systems (OAS), the Merit Network Office, and the Telecommunications Systems Office (UMTel). This consolidation focused attention and resources on planning for and using information technology in all areas of the University

At the time of this re-organization, the Office of Administrative Systems was also undergoing an internal re-organization, prompted in part by a 1984 Nolan and Norton study which recommended that steps be taken to improve end user access to the data available on the central systems. One result was the creation of an Information Center within OAS. A similar re-structuring at the Computing Center brought a variety of consulting, technical writing, and instructional activities under common management in a new User Services unit .

The arrival of our very own Computer Czar brought not the merger which some had forecast, but a series of "projects" which brought together staff from various parts of ITD to tackle common problems. One of these was the User Services Project. Discussions within the context of this project soon revealed a common concern that Schools and Colleges needed planning support across the range of computing issues and that the University needed to guide unit decisions so that the "Information Technology Enterprise" would be coherent, integrated, and efficient in a highly decentralized environment.

ITD management agreed that departmental planning should become a part of the activities of staff in both the OAS Information Center and the Computing Center User Services division. By the end of 1986 a joint Planning Team had been formed to provide planning support to Schools and Colleges within the University. Its announced goals were:

- To make the best use of the wide range of resources within ITD in helping units become more productive;
- To feed the needs of the departments back into the ITD planning process for new or improved systems and services; and
- To enable collaboration between departments.

II. How the DPT is Organized and Operates

The DPT reports jointly to the Manager of the OAS Information Center and the Manager of User Relations at the Computing Center. On the OAS side, there are four Senior Planners and one Staff Planner. Currently, the Computing Center has two senior planning positions. All of the Senior Planners are expected to spend half their time in departmental planning. The OAS planners devote the other half of their time coordinating

development of administrative systems and related activities, while the Computing Center planners are responsible for user relations with external customers, and identifying service needs for special groups of the Center's clientele. The Staff Planner works on specific projects and assists the Senior Planner from the Computing Center in providing administrative data access for her units. Another OAS Staff Planner will soon be added to assist with data access and documentation. Depending on specific project assignments, all the planners work both individually and as members of teams which may include staff from the other parts of ITD and other units of the University.

To provide liaison and communication, a Senior Planner has been assigned to every unit in the University, academic and non-academic, including the two branch campuses. Electronic mail systems permit inquiries from all over the University to the mail group "ITD Plan," re-enforcing the various announcements that "For information on ________________, contact the ITD Planners." Information received from these contacts, and the various consulting and planning projects, is a useful conduit for communication from various constituencies to ITD senior management. These assignments also facilitate the Senior Planners role as intra and inter-organizational troubleshooters. It also means that at least one person in the organization has a vested interest in heading off problems between specific customers and ITD.

III. What the DPT has Done

A. Comprehensive Studies

In the role of consultant, the DPT has produced a number of comprehensive studies for various units on campus. Common elements contained in all plans include extensive reviews of the existing and potential computing activities, hardware and software environments, facilities, organizational structures, and training requirements of each unit.

1. School of Dentistry

The earliest and most extensive study was conducted for the School of Dentistry. In the Fall of 1986, the Dean requested that the DPT assess the current status of all computerized administrative systems within the school and recommend a future direction that would not only enhance these systems but also integrate them with the University's strategic goals for Information Technology. The process for the assessment included:

- interviews with key faculty and staff,
- the development of a computing resource inventory, and
- a review and analysis of the recommendations made by an internal Task Force on Computing.

The planners found this to be an interesting and professionally challenging project. The review of computing support was part of a major review and reorganization of the Dental School in response to changes in the profession of Dentistry. The planners were commissioned by one Dean, but their May 1987 report was delivered to a new Interim Dean and Transition

Executive Committee. Furthermore, while the planners are based in units whose primary function is the delivery of University-wide mainframe computing services, Dentistry maintains an internal centralized computing department to support management of clinic and dental procedure activities. This need to develop plans which include University-wide systems, departmental systems, and individual workstation support has been a distinguishing feature of many subsequent DPT projects.

The planners recommendations included, among other things, the total restructuring of the internal computing department, the purchase of a fourth generation language for clinical applications, and that all microcomputer-based administrative databases be migrated to an appropriate network resource, and be merged with data supplied from the University's Administrative Systems mainframe files.

2. Horace Rackham Graduate School
In the same period, the Horace Rackham Graduate School requested a review of functional administrative areas within the school to identify ways in which enhanced computer support would benefit its operations. Faculty and staff working in the Dean's Office, Admissions, Student Services, Fellowships, and Data Services were surveyed to find out about data needs, current hardware and software configurations, and paperflow and communication processes.

A blend of hardware, software, data access, and connectivity options were recommended along with increased use of the Computing Center mainframe, and better utilization of functions available from the new University Admissions System and data from the Student Characteristics Database. (Both are on the OAS mainframe.) The DPT was gratified to find that the price tag of approximately $100,000.00 for personal computers, printers and connections was seen more as a challenge than a deterrent by the Graduate School's new deans.

3. Museum of Art
The Museum of Art provides another case where a major departmental planning effort in the assessment and recommendation of administrative computing activities took on a slightly different focus. Many of the Museum's administrative activities are in the financial arena, with special emphasis on development and fundraising. Once again, the recommendations included better utilization of databases maintained on the OAS mainframe by downloading information into a Lotus 1-2-3 spreadsheet or a dBaseIII+ database. Again we encountered a local system which needed modernization. One of the Staff Planners on the project spent a lot of time researching possible ways to convert locally maintained data on the "Friends of the Museum" from an obsolete wordprocessing system to a microcomputer database.

The Museum of Art is one of many units on campus involved in the publication and distribution of a wide variety of materials. To what extent should desktop publishing be utilized? Rather than review each item, the DPT presented the Museum staff with a set of guidelines to determine the cost-effectiveness of in-house production and recommended the development of an internal policy based on the outcome of their analysis.

The major administrative function of the Museum is Collections Management, the cataloging, care, and disposition of the Museum's collection. These activities were supported entirely by manual processes at the time of the study. The DPT recommended that the Museum consider acquiring a Collections Management system which could be installed on a Local Area Network (LAN). The LAN approach would enable a number of users to access the information housed on a central file server and pave the way for remote access to this information by students and faculty.

B. Special Projects

The DPT has also coordinated a number of special projects for units on campus. These projects have addressed a variety of computing challenges. A sampling of the projects follows:

1. Division of Research Development and Administration (DRDA)

The occasion for this project was DRDA's request to its new Vice-President for Research for money to upgrade its hodgepodge of terminals, wordprocessors, and microcomputers and provide improved access to computing for its staff. The Vice President requested ITD assistance and a planning team was appointed. In addition to members of the DPT, this team included the Computing Center, and - for the first time - the Center for Information Technology Integration (CITI), the ITD research arm. The University had just received a grant to develop NSF Expres, a system for developing and submitting research proposals in a multi-media networked environment using high-powered workstations. DRDA was expected to be a major user of Expres. It was essential that the equipment plan move DRDA toward that goal.

One of the surprising outcomes of this project was that rather than inching along the path of proven technology, DRDA, in collaboration with CIT_, decided to take a major leap forward. It moved all staff to Macintoshes, linked with an Appleshare network, and then used a Kinetics Fastpath Box and Ethernet to connect to the campus network. A Sun Workstation on this network can be a server and an Expres workstation.

2. The Hospital - Data Systems Center Mainframe Link

Once management agreed to establish a channel-link between the mainframes at the Hospital and the OAS mainframe, the technical work was relatively painless. The DPT planner for the Medical Center then faced the non-trivial task of developing and implementing procedures to ensure 'seamless' access to central administrative files by the Hospital community. Issues addressed during this process included:

- revising paperflow and procedures,
- reconciling different security environments and value structures,
- assessing the need for and delivering training, and
- developing and producing a marketing presentation for Medical Center staff.

3. College of Literature, Scien, ?, and the Arts (LSA) Pilot

Although the University's new telephone system had provided a new twisted pair cable network for data in 1985, the largest academic unit on campus, the College of Literature Science and the Arts (LSA), had resisted use of the system because of budget constraints. Finally, in 1987 ITD and the Dean of LSA negotiated a "Pilot Project" agreement in which a combination of subsidies and special prices were offered for block orders of connections using the twisted pair plant and UMTel Secondary Communications Processors. ITD also promised one half-time F.T.E. for planning and training.

The planners worked with staff in LSA and UMTel to help departments determine their needs for hard-wired data connections, to provide appropriate training and documentation, and to secure necessary signons and accounts on both the administrative and academic mainframes. Over 400 new connections were installed between September 1987 and November 1988.

C. Local Area Network Planning

The advent of Local Area Networks provided a new arena for the Planners. Here was a technology based on a decentralized yet focused approach to computing that had to be meshed with the strategic direction of the University.

Early in 1986, ITD created a LAN committee to evaluate and recommend transport and software products that would run in the twisted pair environment and satisfy a majority of the diverse networking needs on campus. As the recommendations evolved, the Departmental Planning Team was instrumental in identifying 'pilot' departments to participate in a field test of these products. Moving from pilot to production, the DPT was actively involved in the definition of University support for the LAN products selected and in the design of training programs and materials.

University Hospital was one of the first units to field test the LAN products recommended by the committee. These products include a Northern Telecom Meridian ANStar PC which is a transport that carries data at 2.56MB over twisted pair wiring and the Banyan Vines LAN operating environment. Within eighteen months, the hospital moved from test to production and currently has one of the largest Banyan networks in the country. Two of the major applications on the network are a nurse scheduling system for 1000 FTEs and an Operating Room Scheduling System for 35 operating rooms located in three different hospitals in the Medical Center.

The LAN is without a doubt the fastest growing computing phenomenon currently affecting University departments, and the Planners' involvement has burgeoned accordingly. One of the more challenging assignments was to analyze options for the Housing Division to provide inter- and intra-networking capabilities for Housing administration, residence halls, remote family housing, and plant services.

Recently the process was tested by the need to provide LAN and equipment plans for the Offices of the President, the Vice President for Academic Affairs and Provost, and the Vice President for Finance. The plan was precipitated by a staffing change in each of these positions. The first part of the plan provides for inter-networking; the part of the plan yet to be developed will address intra-networking among all of the Executive Officers.

V. Value of DPT to ITD Central Management

In its short but eventful two years of existence, the DPT has proven its value to ITD central management

1. As a lightning rod in controversy;
2. As a provider of factual analysis in disputes;
3. As a source of information and insights to aid in understanding concerns and conditions in Schools and Colleges;
4. As a bridging mechanism to coordinate services while separate operating units focusing on academic/research and administrative uses of computing are preserved; and
5. As a source of leadership for internal marketing and planning activities, providing input to the planning process for new or improved services and /or public relations activities, to ensure that services will match needs.

VI.Challenges/Limitations of the DPT Approach

It has been obvious from the start that there are challenges and limitations to this approach to planning and coordination. The planners are supposed to help departmental managers find answers to <u>their</u> problems, they are not to "sell solutions." However, helping clients identify and evaluate potential solutions compatible with broader University interests can be very difficult when the overall University direction is something of a diaphanous moving target. And as everyone knows, the evolution of technology proceeds unevenly and can make yesterday's good advice seem pretty stupid in retrospect.

Credibility is always an issue. The OAS planners inherited the traditional love/hate relationship between the central administrative offices and their MIS departments. The University's deans and their staffs have the academicians' distrust of all central administrative units. The planners services are provided without charge, but occasionally one wonders whether School and College Deans and directors of major administrative departments really value a "free lunch?"

The DPT provides advice, not resources. Sometimes the object of the planning activity is to guide the customer to decide what to do with his/her own resources; sometimes we assist in developing plans which are

then used to ask Vice Presidents, Deans, or outside agencies for funds or gifts in kind. In any event, the DPT has at best influence, not control, over the outcome of its activities.

Usually significant work with a department begins with a request for specific help with a problem. Part of the Planners' professional challenge is moving from a single project or report to an ongoing, working relationship. When this happens the Planners become a part of the information loop in the department's day to day activities. At the same time the objective is not to encourage dependence, but rather to foster capability and expertise within client departments. A major goal of the DPT is to move Schools, Colleges, and other departments to the point where they can use more of the ITD systems and services without direct support. This requires that the would-be users commit resources to acquire skills and equipment. Frequently new staff positions must be created or old ones re-defined.

As may have been obvious from the brief history of the evolution of the DPT, not all parts of ITD are accustomed to using a Planner in their project planning and product/service development cycle. Thus there is occasional misunderstanding and some internal resistance to the role of the Planners within ITD. Part of the DPT's challenge has been to demonstrate that the use of planning enhances the chances of success for all the parts of ITD.

VII. Outlook for the Future?

A. Management Issues

The DPT evolved from existing positions in OAS, and from a recognition of a need for such services by the new Associate Director for User Services at the Computing Center. Thus it was not surprising to find that the OAS planners have been faced with conflicting demands from their pre-existing responsibilities for planning corporate systems, providing access to corporate data, planning and implementing enhanced overall systems and services for users, and providing general support to central administrative offices. These demands are increasing. The Computing Center's participation in the planning process has waxed and waned as staff turnover and other hot items have demanded attention. Their current Planner is heavily involved in user relations and in planning for enhanced services to the academic comunity. The Computing Center is recruiting another Planner, and the list of internal Computing Center projects awaiting that person is substantial.

Demand for departmental planning services has always exceeded supply, and has been exacerbated by the unpredictability of large requests from highly placed customers. The number of requests have been increasing both in quantity and scope. As understanding of the work and role of the Planning Team spreads some of these problems may lessen. The Planners' managers are working to increase the staffing of the DPT as well as to better manage the workloads of those currently involved. There is a move

toward greater use of matrix management and a team approach to control Planners' workload as well as an attempt to expand the lead time for making assignments. It is also important to foster working relationships and planning activities with those responsible for information technology at the college or division level. These efforts will undoubtedly continue to require close management attention. The Planners and ITD managers will also have to work to reinforce - and sometimes build - the bridges between the service providers and the users. Here too, acceptance and use of appropriate matrix management techniques will be required.

B. Support for Information Sharing, Policy setting, and Need Identification Mechanisms

It did not take long for the Planners to become aware of the various short circuits in the flow of information both within ITD and between ITD and the rest of the University. Communication channels within ITD that ensure that the Planners are aware of directions, decisions, and services is critical not only for the credibility of the Planning staff but for the success of the overall concept. The rapid pace of technological change coupled with the overall size and complexity of the ITD organization makes it a challenge to achieve effective communication.

Information sharing, policy setting, and need identification mechanisms are slowly being put in place and the role of the Planners in them is gradually being clarified. For example, an 80-member Information Technology General Council was established in the Spring of 1988 to improve communication and provide a forum for discussion among faculty and managers from the principal academic, research, and administrative units on campus. Planners are the liaison between ITD and Council members.

C. Changing Nature of Relationships

The nature of the relationships between the Planners and the departments is changing as the internal departmental structures for computing services mature. Initial contacts with departments ranged from requests for unit wide plans to the minutiae of access to a particular administrative application such as Online University Stores Requisitions. As these departments build internal expertise the Planners role is becoming that of "bridge builders" to ITD systems and services, such as LANs, network connections, development of new administrative systems, etc.

D. New Systems and Services

The Planners are also part of efforts to identify operating level contacts for ITD divisions to work with in providing support services and training, and in defining new service needs. In this role they frequently operate at the leading edge where the definition of ITD systems and services occurs. An excellent case in point is the support for departmental systems. In a climate where technology permits and, of

late, is encouraging decentralization, the Planners have become increasingly aware of the need to redefine for the institution what is a "corporate" system and what is a "departmental" one.

While central systems have long had standards and guidelines, departmental systems have been born - and have often died - in a laissez-faire environment where the same sad experiences are repeated over and over by departments. The Planners have been in a position to see the need for ITD to define standards for development of departmental systems and to encourage their adoption by training and support for departmental staff. They have also seen the need for a contract service for systems analysis and even system development for departments which do not have in-house expertise. This is just one example of the issues confronting ITD as it re-defines what it will provide centrally, and what it expects departments and users to do for themselves.

E. Expansion to Include Planning for Academic and Research Activities as well as for Network-Wide Services

As the Computing Center's participation in the planning effort matures and solidifies, the overall planning effort should expand to include more of the academic and research activities. This will probably not include direct instructional activities, but rather such basic service issues as planning for the transition from the MTS operating system to Unix. It is also apparent that the Planners' expertise and knowledge of user needs will play a part in development activities managed by CITI. CITI is involved in a number of joint development projects with vendors and vendor support is increasingly being looked to as a source of funding for our activities.

Our Vice Provost for Information Technology, Douglas Van Houweling, has said that he expects ITD to become the "backbone" service provider for the University. Efforts are already underway to install the networks and to define the various information services that will be provided. Implementation of "the vision" may make ITD less visible to the end user and could raise serious problems of justifying budgets when asked "but what are you doing for <u>me</u>?" The Planners will be of increasing use to ITD as a visible link between the ITD backbone and the end users, maintaining the visibility of those background facilities which link all the individual users and services together.

VIII. Summary

In the late 1800's, Robert Louis Stevenson said, "Wherever we are, it is but a stage on the way to somewhere else, and whatever we do, however well we do it, it is only a preparation to do something else that shall be different." Those of us involved with information technology today recognize that we are involved with constant change and must make decisions today that will "bridge" us to the future. The Departmental Planning Team is helping provide this bridge at the University of Michigan.

THE TRIALS, TRIBULATIONS, AND TRIUMPHS OF ESTABLISHING AND MAINTAINING AN INFORMATION CENTER IN A MULTI-CAMPUS COLLEGE DISTRICT

ANITA ADAMS

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DALLAS COUNTY COMMUNITY COLLEGE DISTRICT
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About four years ago, our District realized that employees had discovered the wonderful world of personal computers. Rather than permit the disjointed purchase of software and hardware to continue, (there were no established guidelines) our executive staff, through our Strategic Planning Committee, formulated a four year action plan. This action plan addressed many areas of our organization, one of which was the support of end users in the data processing area. To better understand their commitment, we hired an Office Support Consultant to conduct an extensive study. The development and implementation of the Information Resource Center of the Dallas County Community College District is a direct result of this study.

This presentation covers the planning process, the implementation, and the operation of this center.

BACKGROUND

The Dallas County Community College District (DCCCD) is composed of seven campuses, a Career Training Center, and two District offices.

The campuses and the Career Training Center operate in many ways as separate entities with their own President and Vice Presidents. The overall District is governed by a Board of Trustees with our Chancellor reporting directly to them. Under the Chancellor are two Vice Chancellors. The Vice Chancellor of Education is responsible for all areas of the District directly related to educational affairs. The college presidents report to this Vice Chancellor. The Vice Chancellor of Business Affairs is responsible for overseeing all areas of the District related to business operations.

We have a centralized MIS department, Information Technology, which resides under the Business Affairs area. The Information Technology department is responsible for all district communications which includes voice and data, Administrative and Educational computing, and end user support.

Each District location has a Data Processing Coordinator, who is the liaison with the Information Technology department.

The Information Resource Center (IRC), a department within the Information Technology division, is responsible for end user support. We officially opened for business on January 2, 1985 charged with the responsibility for the education and support of all District and Campus personnel in Administrative and Office Systems.

OFFICE SUPPORT STUDY

In 1984 a consultant firm, T.H.E., was hired to perform an office automation requirements study for the Dallas County Community College District. The study was conducted using the Data Processing Coordinators and selected user personnel from each campus and the District offices as the study group. The study included:

- users' evaluation of the support currently being provided in the area of data processing and office systems by the Information Technology department.

- user perceptions of their office information systems needs, as well as their perceived future needs, and

- what the users would like accomplished as the end result of the study.

The findings which resulted from the study indicated the following:

<u>Information Technology Support</u>

The perceived need and most requested service from Information Technology was education and training. The need took the form of "information resource awareness and education for the District;" "let us know what's possible;" "system awareness of software;" "provide office systems consulting;" "provide micro education services."

<u>Perception of Office Automation and What it Should Do</u>

Integrated office support software networked across the District was the needed direction that was emphasized by the users. The following list indicates order of popular perceived needs:

- Electronic Mail Network
- Scheduler Package/Electronic Calendaring
- User-friendly word processing
- Tickler Files
- Reminder Aids

<u>Desired Study Results</u>

The desired results of the office automation study fall into the following areas.

- Provide greater end user education in office systems, personal computing, and administrative systems.
- Provide direction in networking present and future installed technology.
- Provide electronic mail and document distribution capability and greater communications potential.
- Provide easy accessible problem resolution assistance.

The consultant's recommendation was centered around the creation of a district office with the responsibility for end user support and the purchase of an integrated office support system. The recommendation was presented to our Board, which subsequentially approved the proposal. Thus, the Dallas County Community College District's Information Resource Center was born.

IMPLEMENTATION

Writing this paper has given me the opportunity to vividly recall a year of my life with experiences that I wouldn't have wanted to miss, but would never willingly go through again. These memories explain why I immediately thought of "The Trials, Tribulations, and Triumphs of Establishing and Maintaining an Information Center in a Multi-Campus College District" as the title for the paper.

The "Trials" started immediately in the form of maintaining my current position responsibilities (user support and writing Administrative systems user documentation), assisting in the vendor selection of an integrated office support system, finding a location for the center, writing job descriptions for the center's staff, and interviewing and hiring the staff.

The selection of a vendor to supply the integrated office support software was deemed to be the first priority by Jim Hill, the Director of Information Technology. He chaired a selection committee which was composed of the Director of District Purchasing, and three secretaries, one from a District office and two from campuses, and me.

We spent what seemed like forever, but in reality, was a period of about three months evaluating office support software. We had developed a check off list of the features essential for our needs. Each committee member completed the check off list during the vendor presentation. This means of retaining our opinions of the software and vendor support proved invaluable. After seeing four or five vendor presentations your recall of particular systems is almost nil. At the end of the evaluation period we tabulated the check off lists, eliminating all but two of the vendors as being unable to supply all of our required features.

The next step was the bid process. We were fortunate that both desirable vendors submitted bids. The ultimate selection of Data General as our vendor was based upon financial considerations.

FACILITY DESIGN

With the selection of a viable office support vendor completed I was able to concentrate on a facility to house the center. In this I was fortunate in locating an area of the District Service Center which at the time the building was constructed had been earmarked for a Centralized Printing Facility but had never been used. Working with a District architect the center was designed not only to meet current needs but with the potential for future growth. The center is composed of:

- Reception area, room for storage of documentation manuals and training material.

- Two classrooms, one equipped with 10 PC's connected to the ISN network and one equipped with 10 TELEX terminals connected through a controller to the AMDAHL administrative computer. The classrooms are separated by a room to house media equipment.

- Office space to house up to three trainers.

- Private office for the Micro Specialist.

- Private office for the Administrative Services Coordinator.

- Private office for the manager.

The IRC moved into the new facilities in August of 1986 after operating out of temporary facilities for seven months.

ORGANIZATION

The IRC is a part of the Information Technology department with the Manager reporting directly to the Director of Information Technology. The center is staffed by six full time employees and one student assistant.

Manager Information Resource Center
Responsible for the overall management of the department.

Secretary - 1
Responsible for our registration system, which includes maintaining the Course Master file, Staff Profile file, Class Schedule file, registers staff in classes, sends confirmation notices, class rolls, enrollment reports, and maintains inventory of training material. She also serves as receptionist for the department and assists with phone coverage.

Administrative Services Coordinator - 1
Responsibilities include liaison with the campus Data Processing Coordinators in problem resolution and maintains Administrative System user documentation manuals,

Micro-Computer Technical Specialist - 1
Consultant for specifications and configuration of microcomputer equipment and configuration of software packages. Evaluates and recommends new products and assists in staff training.

Software System Trainer - 2
Develops training material and teaches classes in all supported microbased software, Office Support software, and Administrative Systems software.

Student Assistant - 1
Assistant to the secretary.

COURSE CURRICULUM

Our course curriculum is divided into two areas, Administrative Systems and Office Support Systems.

Administrative Systems include all computerized support of the administrative functions of the District. Administrative System classes currently taught are:

- Human Resource System
  - Personnel/Payroll
- Job Placement System
  - Student Employment Agency
- OPERA System
  - Purchasing
  - Accounts Payable
- Schedule Build System
  - Development and input of Class Schedule and its relationship to the instructors load.

Office Support Systems include all computerized office function. Office Support classes currently taught are:

- Comprehensive Electronic Office System
  - CEOWRITE (wordprocessing)
  - E-Mail
  - E-Calendar
  - E-Filing
  - Resource Scheduling
  - Telephone Message Routing
  - Reminders
  - To-Do List
- Spread Sheet (LOTUS)
- Data Base Management (Power Base)
- Introduction to the PC
- Managing a Hard Disk
- STARLAN Network

All course training material is developed in-house by the IRC staff. In most cases, classes are taught by the IRC staff, but do utilize pertinent campus and district personnel as their schedule permits.

REGISTRATION SYSTEM

Using Power Base, we have developed a system for registering staff in classes patterned after the DCCCD registration system. The system includes a Course Master file which contains a course description, prerequisites, class length, and identifying sequence number for all available courses. A Staff Profile file which contains the social security number, name, location, phone number, and level of experience of each employee attending classes. A Class Schedule file which contains the Sequence Number, Section Number, class date and time, Social Security number of each employee enrolled, and a code for each employee denoting completion status.

When we began operations, registration was handled through the interoffice mail. As soon as a majority of the employees had been trained to use the E-Mail we established a "Registration Mailbox" so that the registration could be accomplished electronically. The secretary also uses the E-Mail to send a confirmation notice to the employee.

A staff training schedule is produced for each semester. This schedule contains a detailed list of time and date for each class being offered. The course description, length, and prerequisites for each offered class is also included. We use the E-Mail to send the training schedule to all employees along with a limited number of hard copies for each district location.

SCHEDULING

I would like to be able to tell you that we developed a foolproof way of scheduling staff training classes, well it just "aint" so. We learned by trial and error the hard way. Don't schedule classes Monday morning or any time on Friday if it can be avoided. Try to limit each class to no more than four hours. We accomplished this to a great extent by dividing classes into an introduction, intermediate, and advanced sections.

I started publishing a class schedule each month which enabled us to check the previous months enrollment and adjust the schedule based upon demand. This system works very well for the IRC but doesn't always give the employees sufficient time to adjust their schedules to include class attendance. I have therefore gone to a semester schedule. This requires more planning time for the staff of the IRC but has been favorably received by the District staff.

The most important thing I have learned about scheduling staff training classes is to be flexible. Don't hesitate to adjust your schedule to meet the demand and leave yourself some time to accommodate the emergency situation that seems to arrive at least once each month.

OPERATION

After almost three years of successful operations the IRC has been an integral part of the implementation of three new major systems in the District; Human Resource System, OPERA System, and the CEO System. I feel comfortable in saying 'successful' in that all employees received their paychecks, and we have managed to purchase all required goods and services and pay for them. I seriously doubt that there is any employee in the District who, at some time each day, doesn't use the E-Mail portion of the CEO System, and, most important, my contract was renewed in September.

Statistically speaking we have taught an average of 102 employees each month during 1988 and average responding to from fifteen to twenty request for problem resolution each day.

EXPANDED CURRICULUM

A co-worker once told me I would never be able to go back and develop training classes for Administrative Systems which had been implemented before the IRC existed due to the number of new systems and rewrite of existing systems that would be implemented. With the advantage of having an excellent staff behind me, my reaction to this statement was of course I can go back and go forward with the new with no difficulty. I was wrong. Developing good training material and writing good user documentation requires an inordinate amount of time even for excellent staff.

We have managed to keep up with the new and spend every available hour working on the backlog. During the Spring 89 semester we will be offering classes in the Student Records and Registration area, which is a part of the backlog. This class is being developed with the assistance of a campus Registrar and Director of Business Operations and will encompass much more than teaching the staff to use the computerized system. It will include Admissions and Business Office procedures and how they relate to the system. I also hope to include, as applicable, how these offices are supported by our Office Support Systems.

We are also expanding the curriculum to include taping class, both as video and audio. This would allow us to address two of our greatest problems, reinforcement, and training new employees immediately rather than forcing them to wait for the next scheduled class.

ISSUES OF CONCERN

Once I accepted that we couldn't please all the people all the time, I was able to develop a more realistic view of concerns. The top of this list has to be staffing. The IRC is currently understaffed by a minimum of two people. There is always more work to do than our staff is capable of doing. This in turn causes the next concern which is also staff related, burn out. It's difficult to maintain a positive enthusiastic attitude when you are over worked with no hope of ever getting caught up.

CONCLUSION

In conclusion, establising the Information Resource Center has been the greatest learning experience of my life. In this I was fortunate to have had Jim Hill, Director of Information Technology, as my mentor. I also think our success is directly related to the organizational structure of the District, which places the Center as a part of the MIS department. Without the cooperation and support from the other two areas of our department; Computer Services and Communication Services, we would be unable to maintain the current level of service to the end users.

The "Trials" and "Tribulations"; not enough staff, mammoth work load, and unending user problems and complaints are overshadowed by the "Triumphs". The employee who comes to class apprehensive about the new system they must learn; who upon leaving the class at the end of the day smiles at you and says "This is easy, it's not near as bad as I thought it would be". Or the secretary that stops you in the hall to tell you how much easier her job is now with the Office Support training she has received in class. These are the things that keep the staff of the IRC coming back day after day.

PUTTING THE "SERVICE" BACK INTO COMPUTER SERVICES: Organizing computing for the effective delivery of services

The University of New Hampshire - A Case Study

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With the increase in library automation, administrative information systems, and networking, many educational institutions are reorganizing in an effort to better manage computer resources. Formerly separate functional units such as academic and administrative computing, telecommunications, and the library are being combined under a chief "information" officer. This paper presents a case study of the reorganization of computing at the University of New Hampshire in July, 1987. Unlike institutions which are combining formerly separate units, the University of New Hampshire split its computer services department into two separate organizations. The conclusions to be drawn from the success of this reorganization will serve as guidelines for institutions considering reorganization.

Change is thus the major certainty about the environment with which the University System of New Hampshire must plan to deal effectively.

Change, driven by the incessantly evolving forces of science and technology, will continue to be the dominant feature of much of life as we move closer to the 21st century.

--**To Serve New Hampshire: A Strategic Plan,** October 31, 1987

The role of technology in higher education has changed dramatically over the past several years. We are seeing a rapid proliferation of computers in American institutions of higher education. In particular, the growing availability of personal computers has created a new, more sophisticated computer user with increased expectations for service from the computer services department. The question we must therefore ask ourselves is: given the rate of technological change, how do we organize computing on campus to take advantage of new technological opportunities and, at the same time, continue to satisfy users? The answer to this question, we believe, lies in organizing, not only to deal with changing technology, but more importantly, to deal with changing user needs.

Traditionally, the organizational stucture of computing has been governed by technological developments. In the 1960s, given the large mainframe computers, computing was centralized under the computer center director who was, essentially, the custodian of the machines and data. The director's staff consisted of programmers and machine operators, and the business of the department was related to programming and other technical work. The successful delivery of services was measured mainly by the operational efficiency with which jobs, such as payroll, were run. There were very few users as we know them today outside the computer services department itself.

In the early 1970s, with the influx of smaller computers on campus, a number of departments developed technical computer users who could write their own code. As a result, the notion of "service" in the computer services department expanded to include problem solving for these new end-users. Most computer services departments were still organized to manage their mainframe computer centers, however. For this reason, the additional service needed by users in other departments was tacked onto the job of the traditional administrative programmer. These new end-users wanted access to data and technical information, and this went against the administrative programmer's role of guardian and protector of the institution's data. It also went against the belief on the part of computer center directors that centralization allows for more effective management and control. As a result, these new users were often poorly served by the computer services department.

In the late 1970s and 1980s, the growing availability of microcomputers has created a new type of computer user, one that is often non-technical. These new users do not know exactly what they need from the computer services department. What they *do* know is what they need in order to be effective in their jobs. Because they are sensitive to institutional objectives and to differences within and across departments, their tendency is to look to the computer services department to provide "solutions" to a broad array of ill-defined institutional, deparmental, or individual problems. In response to these new users, computer services

departments have added microcomputer support to their lists of services. In some cases, the same administrative programmers who support mainframe computers have been asked to develop microcomputer expertise so that they may provide service to both types of users. In other cases, separate microcomputer support groups have been formed to address the needs of microcomputer users. In both cases, however, the emphasis has been on providing technical solutions to isolated problems and not on addressing the overall needs of the user. Thus, the user's perception of the "service" provided by computer services departments remains negative in many institutions of higher education.

Is the user, especially the non-technical user, in the best position to dictate what services should be provided by the computer services department? With the rate of technological change and the convergence of technologies, isn't the computer services department in a better position to understand which product and service choices are best ? We believe that the successful delivery of service by the computer services department depends on an organizational structure and set of objectives which integrate the opportunities offered by technology with individual, departmental, and institutional goals. To do this requires a clear understanding of both the major trends in information technology and the institution's short- and long-term goals.

According to market analysts, the 1990s will continue the trend toward distributed computing, with large central information databases accessed from powerful workstations connected to national and international networks. There will be a proliferation of local area networks within and across departments and, as a result, a need for increased standards in microprocessor architecture, operating systems, and networking. A more challenging economic climate will create a growing pressure to justify investments in computing, and it will become increasingly difficult to find or afford the computing staff necessary to maintain equipment and provide consulting for users. More applications will be developed by end-users on microprocessor-based systems using fourth generation languages to access relational databases. Systems integration will be one of the major challenges facing both vendors and computer services departments. Finally, more sophisticated users will have even higher expectations from the computer services department, demanding more computing power, additional capabilities such as graphics, text processing, image scanning, and prompt, if not instantaneous, response to requests for service.

For many directors of computing, these predictions may seem to point to a more centralized organization and control of computing in which concerns such as protection of data and standards allowing for compatibility between systems can be addressed. It is obvious that careful planning at an institutional level is necessary if we are successfully to implement a campus-wide network of distributed computing facilities which will appear, to the user, to be one large computer. In addition, a centralized organizational structure will not be perceived by the user as service-oriented. Yet, the users are the reason institutions have computers and employ computer people in the first place. There is, therefore, something wrong with the organizational model of computing which looks only at trends in technology. We must also look at the goals of the institution, together with departmental and individual goals.

Strategic Goals

The University of New Hampshire is the largest of three campuses which make up the University System of New Hampshire. The University of New Hampshire's strategic plan has as a principal goal to be an excellent, nationally-recognized university. Excellence, as stated in the plan, is evidenced by high quality in an institution's programs. National recognition is based on the scholarly accomplishments of faculty and students and the reputation of academic

programs. To achieve these broad goals, UNH's strategic plan has a focus on improving instruction, providing increased support for research, enhancing university resources, and developing interdisciplinary and international programs.

Goals like these have led many institutions of higher education to recognize the strategic importance of computing. Computing can help improve instruction, is essential to research, can provide widespread access to university resources, and can give an institution a competitive edge by helping to attract better faculty and students. It is therefore not surprising that the strategic plans of leading universities often include, as part of the steps outlined to meet stated objectives, elements such as: computer-aided-instruction (CAI) programs to support teaching and learning, networking to provide better access to university resources and off-campus supercomputer sites for researchers, library automation, and programs to implement computing across the curriculum. Similarly, many of the steps outlined to support departmental and individual goals as set by these institutions include computer-related activities.

It is within the context of institutional goals and major trends in information technnology that an institution must determine the organizational structure of computing that will allow it to best serve the needs of users. In addition, a number of internal factors affecting organizational structure must be considered before deciding how to organize and manage computing on campus. These factors, which will differ from institution to institution, should be considered before deciding an organizational structure:

- the relationship of central to distributed computing services in the institution as well as the management of, and responsibility for, distributed services;

- the mix of mainframes, minicomputers, microcomputers, workstations, and supercomputers;

- the institution's networking strategy;

- funding issues;

- the decision-making process for computer-related activities and purchases;

- the reporting level of the department;

- the relationship of computing to other departments such as: telecommunications, media services, printing and publications, the library, and institutional research.

Information about each of the above factors must be taken into account in decisions about how to organize and manage computing on campus. The effect that each factor will have on the organizational structure will depend on an institution's particular circumstances.

Computing at UNH

Historically, traditional principles governed the organizational structure of computing at the University of New Hampshire. From the days of the first mainframe computer locked inside a glass-enclosed machine room in the Science and Engineering Building, there was always a strong belief that centralization allowed for more effective management and control and that the "real business" of the computer services department was running production jobs and ensuring control and security. Any opportunities or problems related to computing were seen as "technical." As such, they were beyond the understanding of anyone outside the computer

services department, with the possible exception of the computer scientists who were considered allies in the early days of computing. Given this view of technology, it is not surprising that all of the computing functions for both the University of New Hampshire and the University System of New Hampshire were organized under a single Executive Director of Computer Services. This director of computing reported to both the President of the University and the Chancellor of the University System and was responsible for making all computer-related decisions for both the University and the University System.

The original computer services organization was made up of three types of people: computer operators, systems programmers, and administrative, or MIS, programmers. The job of this organization was to keep the machines running, to meet deadlines for payroll and other administrative applications, to solve technical problems as they arose, and to ensure the security of data. The long-range goal of the organization was to acquire larger, more powerful hardware so that more jobs could be run faster.

As the research function developed at the university, a need for additional computing power and for a different kind of computer expertise arose. The computer services department, however, with its traditional view of computing, did not immediately recognize this need. As a result, a group of UNH graduates formed a private organization outside the University to provide consulting support to the University's research community.

As more and more academic departments began to recognize the benefits of computing for instruction and research, there was a new need for technical support and services for academic users. Once again, this need was not recognized by the computer services department. As a result, the Office of Academic Affairs put together a small group of computer knowledgeable individuals whose job it was to act as computer consultants for academic users. This group, known as the Academic Services group, reported directly to the Office of Academic Affairs, and thus, like the research computing group, was separate from the computer services department.

The people in both the research and academic support groups were different from the traditional computer services "techie." Many of them had themselves used computers in research or teaching and several of them had PhD's in academic displines other than Computer Science.

Eventually, due to the director of computing's underlying belief in the importance of centralization for effective management and control, the research and academic services groups were incorporated into the larger Computer Services organization. It is interesting to note, however, that the existence of the two support groups grew out of a user-defined need that was not being addressed by the computer services organization with its traditional view of computing. The consolidation of the two service groups into the larger Computer Services organization, on the other hand, did fit in with this more traditional view of computing.

In 1986, the organizational structure of computing at UNH was still governed by the principle that centralization allows for effective management, control, and security. The Executive Director of Computer Services still reported to both the President of the University and the Chancellor of the University System. The Computer Services department consisted of five groups: computer operations, technical services, administrative programming, research computing, and academic services. Many users, however, did not feel that their computing needs were being met. They often made comments about the inability to get "service" from Computer Services. The problems, as they saw them, were many. Instead of solutions to problems, they got technical jargon and instructions on the proper way to request jobs from the

computer services staff. They could not get access to the information they needed in order to be effective in their jobs. As they became more sophisticated computer users, they were not given the flexibility, freedom, and independence they needed to develop their own solutions to problems.

User dissatisfaction was growing. At the same time, there were problems with the implementation of an automated financial accounting system which was to be used by all campuses in the University System. These events, led key administrators of the institution to question the overall organization, management, and delivery of services of Computer Services. In the fall of 1986, the consulting firm of George Kaludis Associates, Inc. (GKA) was asked to evaluate computing at the University and to make recommendations as to the organizational and management structure which would ensure effective delivery of services to the entire University community.

Reorganizing to Deliver Services

The report submitted by GKA recommended the division of the existing Computer Services organization into two separate entities. After extensive on-site investigation, which included interviews with all segments of the University System community, GKA concluded that the needs of all users--whether they be academic or administrative, on the UNH campus or part of the larger University System--would be better served by two separate organizations. Several findings lay behind this conclusion. GKA had determined that the poor implementation of the automated financial accounting system was due, in part, to a plan that lost direction because of an organizational structure and way of doing business which did not ensure necessary communication and accountability. In addition, the dual reporting structure of the Computer Services organization had required the executive director to answer to two "bosses," who often had differing agendas. Finally, as the user community grew, the differing nature, and therefore needs, of the academic and administrative users had not been recognized by a computer services department that was organized along traditional operational lines with the primary purpose of reducing downtime to make production deadlines.

With the approval of the President of the University and the Chancellor of the University System, Betty Le Compagnon, then acting director of the organization to be called University Computing, and John F. Leydon, then acting director of the organization to be called USNH Computer Services, worked to created two separate organizations which would be better able to deliver services to their respective user communities. The USNH Computer Services organization was given responsibility for all large, integrated, mainframe-based administrative systems to serve segments of the University System; its executive director reported directly to the Chancellor of the University System. The University Computing organization was given responsibility for all academic and research computing on the UNH campus. In addition, because of the nature of microcomputing and the similarities among administrative and academic microcomputer users, it was decided that all microcomputer support, for both academic and administrative users, would be provided by University Computing. Since University Computing would serve mainly the academic and research interests of the University, it was decided that its executive director would report to the Vice President for Academic Affairs on the UNH campus.

The resulting organizational structures (see illustration 1) grew out of a strong belief on the part of both acting directors that the primary emphasis of any computer services organization must be on service, and that the goal is to increase user satisfaction. Each of the new organizations, therefore, added a new group with the primary responsibility of providing the best possible service to users.

In order to be successful, the new service groups needed to understand their "customers." The creation of two separate organizations had, in part, been founded on the belief that the nature of administrative computing is vastly different than that of academic and research computing. This can also be said of administrative and academic users. Administrative users come from all segments of the University. An administrative user may be a secretary, an accounting clerk, a librarian, or a vice president. Often, administrative users' knowledge of computers is extremely limited. What administrative users do know is what they need to do their jobs effectively. They know what information they need, and they know when they are not getting that information. They do not see their information needs as being related either to technical problems or to the limits of a particular system. Faculty and researchers, on the other hand, are often highly sophisticated computer users. While they may understand the limits of computer systems and the inevitability of technical problems, they expect prompt solutions to these problems.

The people chosen to be part of the two service groups--Customer Services in USNH Computer Services and the User Support Center in University Computing--had to have a clear understanding of the differing personalities and needs of administrative and academic users. In addition, since these groups were the "first stop" for users, these people had to have a clear understanding of the services provided by their organization and have sufficient knowledge about these services to answer users' questions. For example, staff members in the User Support Center of University Computing might be called on to answer questions related to such diverse topics as: getting an account on one of the mainframe computers, using the University's scanning service, repairing a microcomputer, or using WordPerfect. Finally, two of the most important personality traits needed by the staff of these two groups are understanding and patience. As with any service organization, the staff of these two groups must always try to understand and sympathize with the customer's point of view. If this is impossible, they must remember that "the customer is always right," since, it is our belief that the proper training, consulting, and communication will prevent most customer dissatisfaction.

Because of the importance of training, consulting, and communication to user satisfaction, these areas have important roles in each of the organizations. And, it is important that the strategies developed for training, consulting, and communication recognize the differences between academic and administrative users. Because administrative users tend to be less computer literate, training and consulting for these users must take an easy-to-understand, step-by-step approach. A classroom environment may work well for administrative users who will be using systems in similar ways, since they will then have the names of "classmates" to call with questions. Faculty tend to be more computer literate or, at least, to think of themselves as more computer literate. For this reason, they are often unwilling to admit they do not already know how to use a computer or a particular software package. A one-on-one teaching environment may therefore work better with academic users. Another learning environment which is attractive to the more sophisticated academic user is a faculty software library where faculty may sit down by themselves, try new software, and ask for help when they have a problem. These few examples should point out the need to tailor training and consulting to the needs of the user.

For a service organization, training, consulting, communication, and a customer orientation can be considered the "marketing" strategies of the computer services department. A number of important premises lie behind the successful implementation of these strategies. The first premise is that there is no such thing as too much information on available services. In both USNH Computer Services and University Computing, a great deal of emphasis is placed on communicating with users about available services. Communication may take the form of

one-page flyers, brochures, newsletters, articles in campus newspapers, special mailings, one-on-one training, short courses, seminar series, open forums, or conferences. The form of communication chosen depends on the characteristics and the needs of the audience to be reached. Usually, a good rule of thumb is that anything you want people to know about should be communicated at least three times, in three different forms.

The second premise is that successful written communication depends as much on form as content. In an age where an overabundance of the printed word threatens to render it ineffective as a means of communication, a document must be attractive and easy to read, with a purpose which is immediately evident, if it is to have any chance of communicating effectively to its intended audience.

A third premise underlying these marketing strategies is that ease of access to computing is critical. "Ease of access" may simply mean providing adequate information to users about computing on campus. It may also mean simplifying procedures for obtaining accounts on mainframe systems or redesigning scanning request forms to make them easier to fill out. On a department level, it may mean creating workshops on using electronic mail, then following up with weekly electronic mail messages containing information of interest to the department staff members. At the University level, it may mean creating MS-DOS or Macintosh users' groups so that users can share solutions to common problems or undertaking a year-long coordinated effort to introduce a new student information system to the University community through a gradual education process, including such activities as forming committees to encourage user involvement, holding regularly scheduled meetings, conducting hands-on workshops, distributing monthly newsletters, and reporting on progress on a regular basis.

A final premise underlying the marketing strategies of computer services departments is that technological obsolescence must be planned for with extensive user involvement. Since most users believe that if the system works, you shouldn't change it, and that when you do change things, they never work as well as they did before, they may not understand why a given computer application which works well on one computer system must be converted to run on another. The fact that the original machine will no longer be supported by the vendor, that the maintenance costs are five times that of newer systems, and that the power and space needed for the system far exceed that of newer machines, is of little importance to users. Users also will not understand why you want them to change from a microcomputer which uses CP/M as its operating system to one using MS-DOS, or from one version of a particular software package to an updated version. As long as they have what they need to do their job, technology is of little importance to users. Without extensive education and involvement of users, every move from one computing environment to another will be seen as a mistake by users. With the proper education and involvement, however, users can become advocates for change and will actually help sell the need to "retire" hardware and software.

While it is clear that the creation of two separate computing organizations allows each to tailor its applications, expertise, and services to a more homogeneous community of interests, it is less clear how such an organizational structure can deal effectively with the problems and opportunities which the evolution of technology brings. As technology converges, organization lines begin to blur. As institutions plan for voice, data, and video communications to allow for educational enhancements such as instructional T.V. or better access to the library, the need arises for a coordinated plan involving departments such as telecommunications, the library, media services, and computer services. It is our belief that an organizational structure driven by goals, not technology, *can* effectively deal with changing technology. In fact, it would be impossible to create a static organizational structure to reflect changing technology. A better approach to dealing with the convergence of technologies is to overcome the

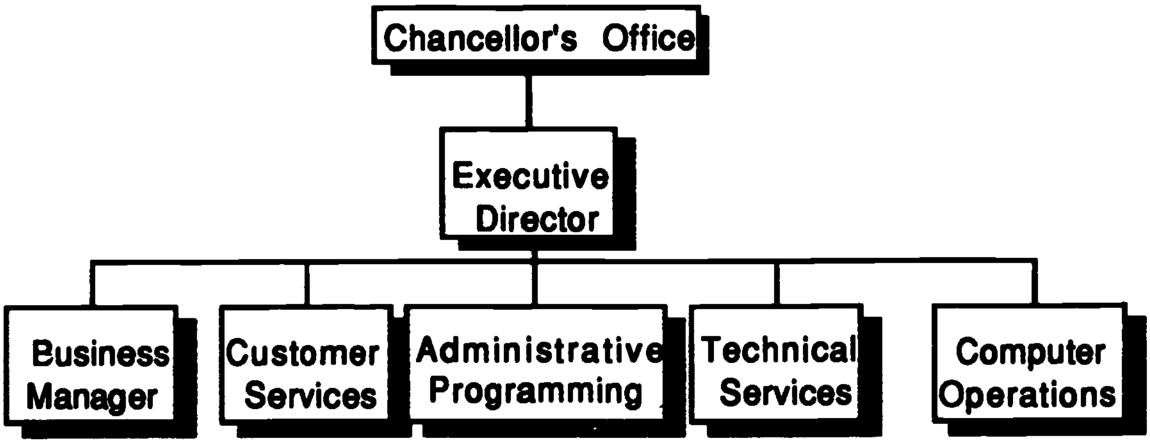
organizational rigidity of the departmental structure. It has been our experience that committees made up of staff members from different groups within a department, from different departments, or even from different campuses within the University System can be extremely effective in defining needs and designing and implementing projects to meet those needs. And, these committees are apt to be more effective precisely because they have a common need and not because they are members of the same department. Thus, the keys to successful management of technology lie not so much in a particular organizational structure, but in clearly defined needs and responsibilities and adequate communications.

Conclusions

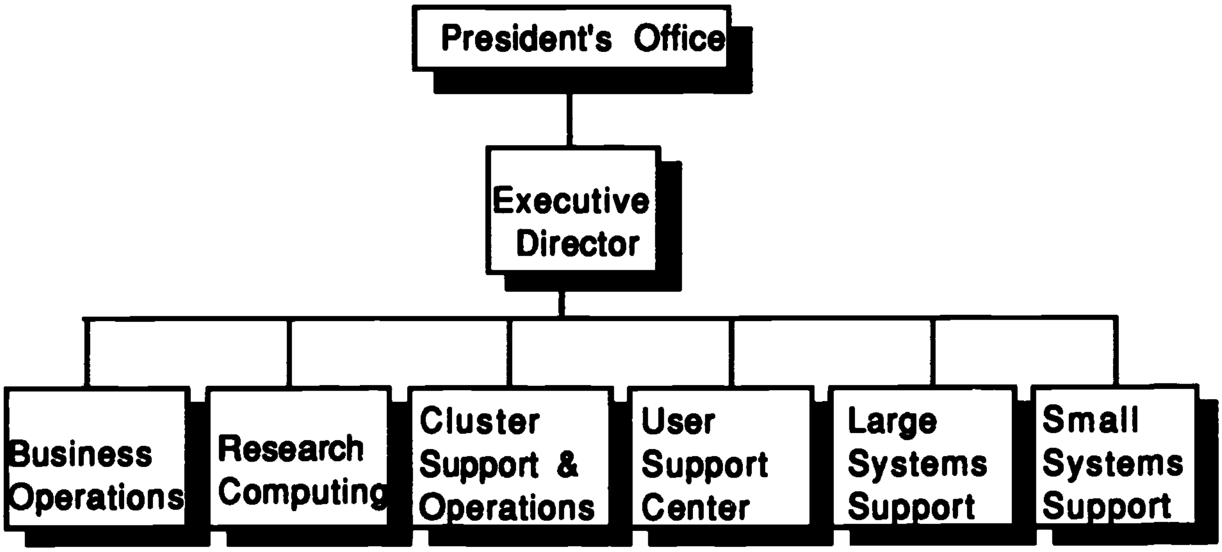
The conclusions to be drawn from the successful reorganization of computing at the University of New Hampshire can serve as guidelines for other institutions considering reorganization. In deciding how to organize, institutions must ask themselves questions, not only about future trends in technology, but also about institutional goals and internal factors which might limit organizational choices. Once they have answers to these questions, institutions will be in a good position to determine how best to organize computing for the successful delivery of services. Given the diversity found in institutions of higher education, however, it is clear that there is no one right way to organize and manage technology. While the questions institutions must ask themselves are similar, the answers will depend on individual circumstances.

Illustration #1

U.S.N.H.
Computer Services Organization



U.N.H.
University Computing Organization



MANAGING FOR SUCCESSFUL INNOVATION

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A manager feels obligated to claim to be interested in innovative solutions, but is that manager willing to take the steps necessary to create a management environment which promotes innovation? There are no quick, simple fixes in making the workplace exciting, lively, and friendly to innovation. This paper addresses a managerial process, in terms of attitudes, beliefs, skills, and tools, necessary to create such an environment.

MANAGING FOR SUCCESSFUL INNOVATION

I. INTRODUCTION

A manager feels obligated to claim to be interested in innovative solutions to management problems, but is that manager willing to take the steps necessary to create a management environment which promotes innovation? There are no quick, simple fixes to making the workplace exciting, lively, and friendly to innovation. This paper discusses the managerial process, in terms of attitudes, skills, and tools, necessary to create such an environment.

What is innovation, and why should a manager be interested in promoting it? Innovation is the act of creating something new. This could be a process or a devise or a method. These new creations are the "new mousetraps" which help an organization to become a high performer and achieve its goals. This is true regardless of whether the organization's mission is to provide a service to society or to make profits for shareholders.

This report is based upon actual experiences at Texas Tech University from 1981 to 1987 wher innovation in the service departments was promoted through the creation of a new work environment. Detailed information is available in the Annual Report of Accomplishments for Fiscal Year 1987, published by the Finance and Administration Division of Texas Tech University, which validates the improvements in service which accompanied the innovation; however, all these individual achievements in the service department area can be summarized in four statements:

-- A nationwide survey of students rated Texas Tech University as significantly better than the average university in the maintenance of buildings and grounds and the handling of student administrative matters, such as billing, fee-payment procedures, and registration.

-- The cost per student for general administration is one of the lowest of the three dozen Texas public universities.

-- The cost per unit for building maintenance, custodial services, and grounds maintenance are among the lowest of the three dozen Texas public universities.

-- In recent years Texas Tech has consistently won one or more awards in the annual cost reduction program sponsored by the USX Foundation and the National Association of College and University Business Officers.

This paper does not attempt to hold out Texas Tech as a model of efficiency and effectiveness in the operation of service departments. The institutional management would quickly agree that they have a long way to go before coming close to perfection. The purpose of pointing out recent successes is that they coincide with recent changes in the management environment. Concerning management attitudes, beliefs, skills, and tools discussed below, few, if any, are unique to Texas Tech; however, the

grouping and implementation are interesting. Even more interesting is the impact upon the achievement level.

II. DEFINITION OF THE MANAGEMENT ENVIRONMENT IN TERMS OF ATTITUDES, BELIEFS, SKILLS, AND TOOLS

The management environment of an organization can be defined in terms of the attitudes and beliefs that management shares, the common skills of the management team, and the tools used by the management team. This integrated set of characteristics has a significant impact upon creating an environment which promotes innovation.

ATTITUDES AND BELIEFS

The management environment is not defined by a statement from management, but by what the managers themselves believe and how they act. In order to change the environment, individual managers must buy into these changes. New attitudes and actions cannot be implemented by simply defining them. Managers must accept them as their way of life.

At Texas Tech the managers and supervisors of the service departments of the Finance and Administration Division believe they are different from those in other organizations. They believe they have developed a common sense of who they are. This was illustrated by an unrehearsed brainstorming session held in the spring of 1988 at an annual planning retreat where the thirty principal managers within this division were asked to describe the attitudes and beliefs that they felt the Finance and Administration management had in common. In this freewheeling session, within fifteen minutes a comprehensive list of attitudes and beliefs was mutually developed. The following is the unedited list:

Common Attitudes and Beliefs

-- accountable/accountability.
-- you can make waves if in the pursuit of improvement.
-- you can make mistakes if in the pursuit of improvement.
-- open/participative management.
-- no back-biting/not political.
-- customer oriented (external).
-- innovation encouraged.
-- nothing gets lost; i.e., assignments are not forgotten.
-- continuously setting goals and follow-up.
-- teamwork.
-- friendly competition.
-- talk to your customers.
-- information flows up and down the organization.
-- professionalism.
-- keep supervisors and subordinates informed.
-- what you accomplish is more important than how you do it.
-- recognize achievement.
-- delegate.
-- follow-up.
-- more paperwork.

-- "if it ain't broke, don't fix it" is not the motto/"be the best you can be".
-- question if it's the best.

During this discussion, an observer could detect from the participants a prevailing sense of ownership and pride that these were firmly held common beliefs within the organization. It is the same kind of feeling that some athletic teams exude when they truly believes they are different and better than other teams because of one or more noble characteristics. It has been shown that a belief can become reality if there are no overriding physical impediments.

The philosophy of the Texas Tech service department managers was developed slowly over several years. The leadership felt that to create the environment desired, these attitudes and beliefs had to be held and practiced throughout the organizational structure from bottom to top. This philosophy was informally suggested and nurtured by the leadership through example, coaching, and cheerleading. Managers were coached and then they coached their subordinates. This did not happen haphazardly. It required a dedicated, conscientious effort and a structured management system which facilitated the setting and following up of goals.

The above listed attitudes and beliefs can be condensed into the following set. It is interesting to note that, while used by the division leader as a blueprint, these attitudes and beliefs were never shared. Instead, each piece was passed along and reinforced, usually by the Socratic method, at appropriate times when that attitude or belief could be incorporated into a decision, policy, procedure, or "lesson".

1. The credo is "be the best we can be -- and that's damn good".

2. Practice participative management. Each person has the right and the obligation to state his opinion. Candid discussion and disagreement are expected and not considered disloyal. Respect for the opinion of others (superiors, peers, subordinates) must be shown. When a decision is reached, all accept it and work as if it were their own. Discourage anyone from sitting back and saying "I told you so". The "boss" is respected, but is not God.

3. Don't play political games. Vindictive action against peers is self-defeating, a waste of energy, and inappropriate.

4. Keep score and give feedback to the players. Assignments are tracked and followed up. Formal customer evaluations and surveys are made. Measurements are taken. Routine personnel performance evaluations are conducted.

5. Be results oriented. Goals are continuously set, and measurements of attainment made. An important measure of success is the customer's perception.

6. Encourage innovation if it results in improvement.

7. Allow people to make mistakes in the pursuit of improvement. The most effective way to learn is through mistakes. If one never makes mistakes, he is probably not trying hard enough. It is part of the coach's job to assure that subordinates do not make mistakes which threaten either the subordinates' or the organization's survival.

8. An unacceptable mistake is to knowingly hide a problem from one's superior.

9. Challenge people to be successful and then celebrate their achievements.

10. A manager is measured by the success of his subordinates. A manager is expected to develop and support his people.

11. Delegate but don't abdicate. This means that one not only delegates authority and responsibility, but also sets specific goals and timetables and then follows up. This is the antithesis of the management concept of "hiring good people and leaving them alone".

12. Practice the good care and feeding of monkeys. Each person feeds his own monkeys (i.e., is held accountable for his own responsibilities). A manager does not feed his subordinates' monkeys (i.e., reverse delegation is not permitted). Subordinates are expected to bring solutions when they report problems.

13. Use the chain of command. The chain can promote and strengthen good management; however, don't let it prevent good horizontal communication.

14. Have fun and keep a good sense of humor. Laugh at yourself occasionally.

SKILLS

The managers within the organization must have certain basic skills. Some are more important than others. The following are some of the skills which Texas Tech has worked to improve:

1. Communication. It is important for managers to be able to communicate orally and in writing. The best way to improve is by practice; therefore, managers from the bottom to the top are given frequent opportunities to make presentations on their goals, achievements, problems, and solutions to problems. Presentations are frequently critiqued. The same is true of written presentations. Most managers have found it necessary to sharpen their writing skills.

2. Evaluation of Personnel. Formal structured evaluations are encouraged.

3. Time Management. Through numerous joint training sessions of all managers, time management skills were improved. The joint sessions were found to be necessary to create a common set of beliefs in and

knowledge of specific time management techniques. It is most effective for the organization when all managers have a common understanding of techniques such as screening calls; the correct way to conduct a meeting; how to effectively use a secretary; how to follow-up on agreements; and how to develop and maintain a procedure system.

4. Techniques for Planning and Problem Solving. Through training, practice, and incorporation into the method of operation, middle and upper-level managers of the Finance and Administration Division have developed their skills in the use of several planning and problem-solving techniques, including time-action planning, brainstorming, and performing SWOT (Strengths, Weaknesses, Opportunities, Threats) analyses.

5. Coaching. Through example managers are taught the coaching techniques for working with their subordinates. Managers understand that they are responsible for developing their subordinates and that their success is, at least partially, measured by the successes of their subordinates.

TOOLS

While not as important as attitudes and beliefs, or even as important as management skills, tools nevertheless play a key role in defining the management style of an organization. The most prominent management tools used in the Texas Tech service department areas are:

1. Management by objectives. Some organizations have been brought to their knees by the paperwork required to implement an MBO system. The basic objectives of Peter Drucker's ideas can be lost in all the numbers. Texas Tech's administration believes that if correctly implemented, this problem can be avoided and an MBO system can provide a complete framework for effective management. Texas Tech has been well pleased with their five-year-old implementation of the guidelines presented in MBO Goes to College by Art Deegan, et al. Formal reviews of progress are held twice a year.

2. Project management system. Tech believes it is important for each manager to have a system for developing, assigning, and tracking both long-term and short-term projects. In the Finance and Administration Division, all assignments are tracked.

3. Annual report of accomplishments. This tool is used to promote communication of what is happening in each of the various service departments as well as facilitating the setting of goals, giving appropriate pats on the back, identifying difficult problems to be solved, and improving writing skills.

4. Annual planning and development retreats. Within the Finance and Administration organization, the annual planning and development retreat has been institutionalized into a two-day session held at a rustic, off-campus location. The purposes of this retreat are:

-- Training of all middle and upper-level managers in one management te inique selected as the area of concentration for that year's session.

-- Review of mission statements and goals from the prior year. Innovative goals are set, and problem-solving sessions are held.

-- Free-time activities (e.g., canoeing rapids) help build the basis for professional teamwork.

5. Annual "show and tell." Annually, each of the primary service departments gives a ten-minute show-and-tell briefing. These are held over three afternoons in one week. Each manager has ten minutes to review his mission, goals of the previous year, results on achieving those goals, and goals for the next year. One hundred percent achievement of all goals is not expected. The division vice president provides a critique of each presentation. Although attendance is not mandatory, most managers attend all three sessions.

6. Evaluation/feedback systems. There are several institutionalized feedback systems for evaluation of performance. These include a formal annual administrative evaluation survey of academic departments to rate the work of service departments. Customers (academic departments) confidentially provide specific ratings in five different areas. One of the MBO indicators for each service department head is the service rating by academic departments. The service department head, along with his superior, sets the service rating goal for the next year.

   Departmental visits are made regularly by service department heads to academic departments. Results of these visits are documented with copies provided to concerned managers.

7. Policy/procedure system. The division has a commitment to the development and utilization of a formal system of written policies and procedures. There is not a special office which writes policies. On the contrary, each department head is responsible for the publication and updating of the procedures in his area. These are used across the university. A specific format is used, and regular reviews and updates are performed. User departments, through their deans, have an opportunity to review and comment on new procedures before they are published or updated.

8. Structured staff meetings Structured staff meetings are held at each management level. Over a period of several years, primary managers have been trained in their use. These staff meetings provide a forum for tracking assignments, developing action lists, and communicating what's happening both up and down the chain of command. Staff meetings are not used for problem solving, but rather communication.

III. ASSESSMENT OF THE BENEFITS AND BURDENS OF MANAGEMENT FOR INNOVATION

The management environment of the service departments at Texas Tech University was altered through changes in management attitudes, beliefs,

skills, and tools. This new environment which facilitates successful innovation has both benefits and burdens:

1. Benefits to the Institution

   a. More innovative solutions are identified.

   b. There is improved planning with a focus on the future.

   c. There is an improved level of professionalism in the staff.

   d. There are improved communications up and down the chain of command.

   e. There is improved motivation of the staff.

   f. Service departments are more results-oriented.

   g. There is a higher level of achievement across-the-board.

   h. The staff have an improved sensitivity to the mission and goals of the department versus a concentration on activities and resources. The department tends to be more outward-looking than inward-looking.

   i. Political game-playing is reduced.

2. Benefits for Supervisors in the Service Departments

   a. Responsibilities and authorities are better clarified. Ambiguities of expectations are removed.

   b. The environment provides a good framework for coaching.

   c. The environment promotes a more positive supervisor-subordinate relationship.

   d. The environment improves motivation of subordinates.

   e. The environment assists subordinates in reaching their potential.

   f. Assignments aren't forgotten.

3. Benefits for Individual Employees in the Service Departments

   a. The workplace is more lively and exciting, and more friendly to suggestions made by employees.

   b. Responsibilities and authorities are better clarified.

   c. There is a measurement by known performance standards.

   d. There is improved job satisfaction and recognition of accomplishments.

4. Burdens

a. There is increased paperwork.

b. The new management environment provides managers greater control and ability to increase pressure for performance. If managers misuse this power, it can frustrate subordinates with ever-increasing performance standards.

c. There can be an over-emphasis on implementing new methods and procedures which have only marginal improvements.

d. There is a more structured management environment. Some people prefer a more laid-back approach.

e. Because this management environment provides good reporting and control, there is the danger that the "boss" can get too low in the operation of the organization thereby usurping the authority of the subordinate.

f. Many of the tools which make up part of the environment, such as MBO, can be misused in a cookbook approach. If this approach is taken, losing sight of goals and objectives, the management environment can deteriorate into a paper-pushing bureaucracy.

IV. SUMMARY

The Texas Tech case demonstrates that the management environment can be consciously altered to create an atmosphere more friendly to innovation. While both benefits and burdens were found to exist, the results were positive for the university. Increased innovation contributed to improving the performance levels across-the-board in those departments studied. Implementation of changes in the management environment required a dedicated and concerted effort over a number of years.

Organizing for User Services

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Abstract

The decentralization of computing coupled with the growth of office automation has created the need for campus wide, comprehensive support for the end user. While the "traditional" university computer center contains organizational units that collectively can meet many of these end user needs, a change in structure and attitude are necessary. While these user services can be provided by several university units, the computer center provides a natural focus for well planned, cohesive support. This paper examines planning, support and accountability in addition to the organizational issues of user services.

Presented at Cause 88
Nashville, Tennessee
December 1988

I. Introduction

California State University, Fresno is a large comprehensive public university offering a wide range of bachelor and master degrees. The campus has approximately 18,000 students, almost 900 faculty and a like number of staff. Five years ago the campus embarked upon an office automation project to bring computing to the departmental and administrative offices. Since then, the campus has progressed from 6 dedicated word processing workstations to over 300 intelligent workstations in administrative offices which are connected via local area networks. In addition, there are approximately 400 faculty members with stand-alone workstations that require some level of computer center services. The user community (faculty, staff, and administration), expecting support from the campus computer center, has expanded from approximately 150 to over 1,000 in that same period of time. The success of this office automation project is clearly evident, but it has had a much broader impact: it has changed the computer center in ways that were never expected nor imagined.

II. Organization of the "Traditional" Computer Center

University computing centers have traditionally consisted of three major components: administrative programming, instructional support, and operations. Some centers have also (imagine this) had a separate planning area. But all these areas have been essentially separate with no real reason to interact (save the planning function). Table 1 shows this organization and its major functions. This type of organization served the needs of the university well until a few years ago. "Traditional" users worked on a centrally supported mainframe using applications developed or at least supported by the

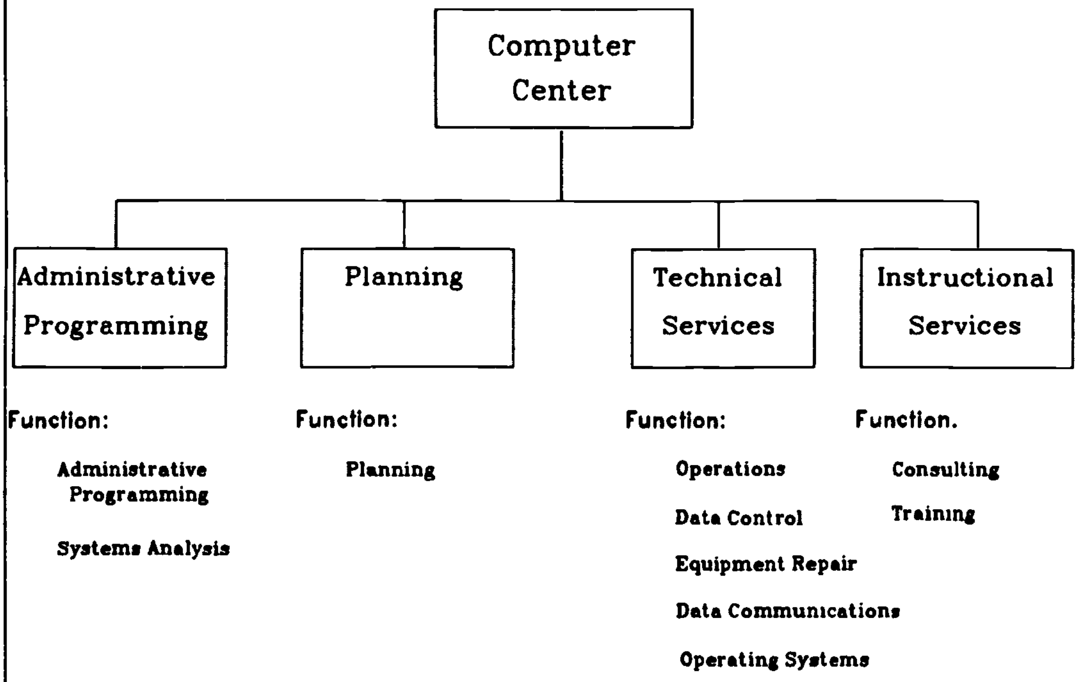

TABLE 1

computer center staff. These users tended to group homogeneously in their uses of the computer by application (i.e., administrative staff used the central system for student records and accounting while the faculty and students used the mainframe for research and instruction). This lent itself to the computer center organizing its support around these groups. The administrative needs were met by the "gurus" who designed, implemented and trained (the few users that needed it) on centralized systems that supported the administrators and financial planners on campus. The instructors and researchers consulted their "experts" and received primarily one-on-one attention for their needs. And everybody assumed that the operations staff simply did whatever they did in the cold, dark computer rooms that made the machines work and the printouts magically appear at predetermined destinations. And that essentially took care of ALL computer users on campus.

Then the simple world of centralized resources (equipment and staff) began to change. The "CPU on a chip" microcomputer age was upon us. At first this only meant that there were a few more users and a few more applications for our "experts" to work with. For the instructional staff, formal workshops began to take the place of the one-on-one consulting. The microcomputer age also brought with it the problem of maintaining many new workstations. But even that problem was generally solved by assigning this function to one of the existing areas, adding staff, and begging for the necessary budget. And, for the moment, both administrative programming and operations remained untouched.

What most computer centers were not ready for was the introduction, in large numbers, of intelligent workstations to the administrative and secretarial staff of their university. Once that process began, the computer center's organization would never be the same again.

The new users are primarily using desktop computers, using office application software, (e.g. word processing, spreadsheet, terminal emulation) and other applications not developed by the computer center staff. The new users that need word processing and spreadsheet support can be accommodated by the traditional instructional support area by expanding the training and support structure. Unfortunately for the computer center, the needs of the new user usually move beyond these basic uses.

These new users differ significantly from the traditional users in their need to develop a "working knowledge" of computing with a range of applications that include not only office products but also mainframe access to student records and accounting systems. And needs do not end there: electronic mail access, desktop publishing capability, and local database development become important priorities. These new users need extensive training to understand computing systems and take full advantage of the computing technology that is now available. They need consulting services to assist them in choosing appropriate hardware and software and, in general, they need more hand holding and training than their "traditional" counterparts.

The needs of the new users do not fit nicely into the "traditional" computer center organization because the heterogeneous mix of applications that crosses over the unit boundaries within the traditional computer center creating an ambiguous environment for most users. The training group that was put together for office automation (word processing and spreadsheets) is not capable of supporting student records access or the centralized accounting system. That function is supported by the administrative programming group. Even with the best of communications, the users may not know who to call when their desktop office automation workstation is running an administrative application. They now have several different people to call and it is sometimes unclear as to what kind of problem it is (e.g., terminal emulator problems running an administrative system on the mainframe) and who is responsible for solving the problem.

III. Issues That Result from Decentralized Computing

Office Automation

While centralized computing has been the major computing emphasis on university campuses for years, it has now been upstaged by the decentralized desktop, intelligent workstation. Offices that have been using centralized systems are now tracking their own budgets and expenditures with spreadsheets at their own workstations. Departmental inventories, student information, and scheduling information are being kept in "local" databases not developed or maintained by the computer center. These "new" office applications are now accomplished without using centralized resources and are not necessarily supported by the computer center.

Office automation has now become an established part of everyday business. And because it is so integral to everyday office operations, selecting systems that work (both hardware and software) is essential. Selecting and installing office automation systems is the easy part, the difficult part is support. While microcomputers are easier to train users on, supporting office automation is still resource intensive and, at a minimum, requires an extensive training and support program. In addition, once the user begins to see the power of the office products they use, access to centralized resources is expected as well. Users soon want to automate as many phases of their operation as possible; they want this equipment to fulfill its promise of higher productivity and greater access to information.

Significant increase in the number of users

The explosion of office applications and desktop computing has brought with it an explosion in the number of users. Even if these were all "traditional" users, it would require additional staff to properly service them. When you add the increased demands being made by these new users, you have a support task of significant proportions.

To further compound the situation, most of the new users are new to computing, but they need to gain a "working knowledge" of computing in order to perform the more technical aspects of their jobs. This requires considerably more staff time to "hold their hands" through the learning process. And in depth training takes significantly more time to include in a training program.

A well planned training program is essential if office users are to reach a higher level of productivity quickly. Another benefit of training is that users learn in groups and create informal consultative arrangements with their coworkers. This results in an even higher level of "hand holding", less computer center staff time, and a shorter learning curve. Beyond training however, hours are spent on the telephone and in person helping the users become proficient in office technology. However, in the long term, this "hand holding" is cost effective for the university in terms of higher productivity and greater technical expertise.

Developing and Supporting Databases

As users become more familiar with computing they naturally progress into database applications. The problems arise when the user develops their own database and then runs into trouble. The user invariably looks to the computer center for assistance. The challenge for the computer center is to find a way to assist the user without expending an enormous amount of resources and still keep the user responsible for his or her own applications.

Another database issue, whether developed by the user or the computer center, is deciding on which computing resource it belong. It can be stand alone, networked for a small number of users or placed on the mainframe. There are many technical and logistic issues that need to be considered. The major concerns are: the size of the database (don't put large,

shared databases on a local area network), the number of users sharing the database, the location in the network of the users sharing a database, and the tools available to develop the database.

It is important for the users to understand that developing their own database – on any hardware – will severely restrict the support the computer center can provide. Essentially, user developed databases will only get consulting support; it will be the responsibility of the user to actually fix their problem. Additional issues that users need to be made aware of are database security and backup provisions. If these issues are discussed early, the user is less likely to feel abandoned later.

Standards

Any support unit recognizes that it cannot meet all the requests of all its customers. Since new end users outnumber the traditional users many fold, decisions on the extent and typ- of hardware and software support must be made early. The university community will initially balk at standards, saying something about "academic freedom", but the alternatives are less acceptable. The computer center has always made choices regarding its commitment in staff and funding to support campus needs. The only difference here is in the number that are affected: the choice of a mainframe statistical package will create concern for a few dozen faculty while a word processing standard can create a debate amongst hundreds of users.

The significant points in choosing standards are to consult with the university community and to publish these standards regularly. Often the user perceives that he/she cannot, for example, "buy the PC of my choice". The view of the computer center, however, should be that the choice is up to the user: they can purchase a standard hardware or software product and receive support or purchase a non-supported product and be responsible for making the software work or fixing the hardware. As in the previous discussion on database development, the better the user understands the reason for standards, the less likely they are to feel abandoned when they have a problem.

Who provides the services in this decentralized environment?

In providing for user services, the computer center has the unique opportunity to increase its value to the university by providing needed services in a cohesive manner. The opportunity to work closely with every facet of the university not only makes the computer center more aware of the university's function and mission, but also allows the university to appreciate the computer center's importance.

While other university units could decide to take on the tasks of user services, the expertise already exists in the computer center, and any other unit would have to rely heavily on computer center expertise. The computer center is increasingly becoming a service, not a production, organization and the needs of user services naturally fit into this role.

IV. Evolving the organization to support User Services

The new user group is now making demands on all the areas of the "traditional" organization: The administrative programming group is expected to provide for local data bases that run on desktop computers as well as for the downloading and uploading of data with mainframe databases. Instructional support is expected to provide the consulting and training for these new users. And operations is supposed to provide for backups and paper and ribbons as well as the installation of workstation, cables, printers, networks and communications.

For the first time, significant numbers of users are needing and requesting services from every segment of the computer center staff. For the first time, members of the computer center staff from all its component areas, need to be talking to and working with each other.

Where does user services belong? Everywhere!

Where do you place it organizationally? (This is not a one word answer).

Because user services support comes from all aspects of the organization, it is necessary for the organization to change, not only on paper, but also in attitude. The separate areas of a computer center must undergo a change in its interpersonal communications structure in order to take care of these users. The important point is that it is difficult (if not impossible) to place ALL the user services support in a separate organizational area; consequently, the computer center must be certain that internal decisions have been made that address all the users needs and avoids leaving them hanging.

This may not be nearly as difficult as it first seems. The first step is to define a user services area and provide staffing. Using this unit as the kernel, the support structure can evolve readily. The placement of this new area will depend on the existing organization and upon the size of the user community. The major functions of user services include training, consulting, hand-holding, equipment installation and maintenance, interface with centralized resources (mainframes and networks), and creation and support of small user databases. The new user services unit can be organizationally placed in three areas: a stand-alone unit reporting to the director (see Table 2), included as a unit reporting to "Instruction" or included as a unit reporting to "Administrative Programming".

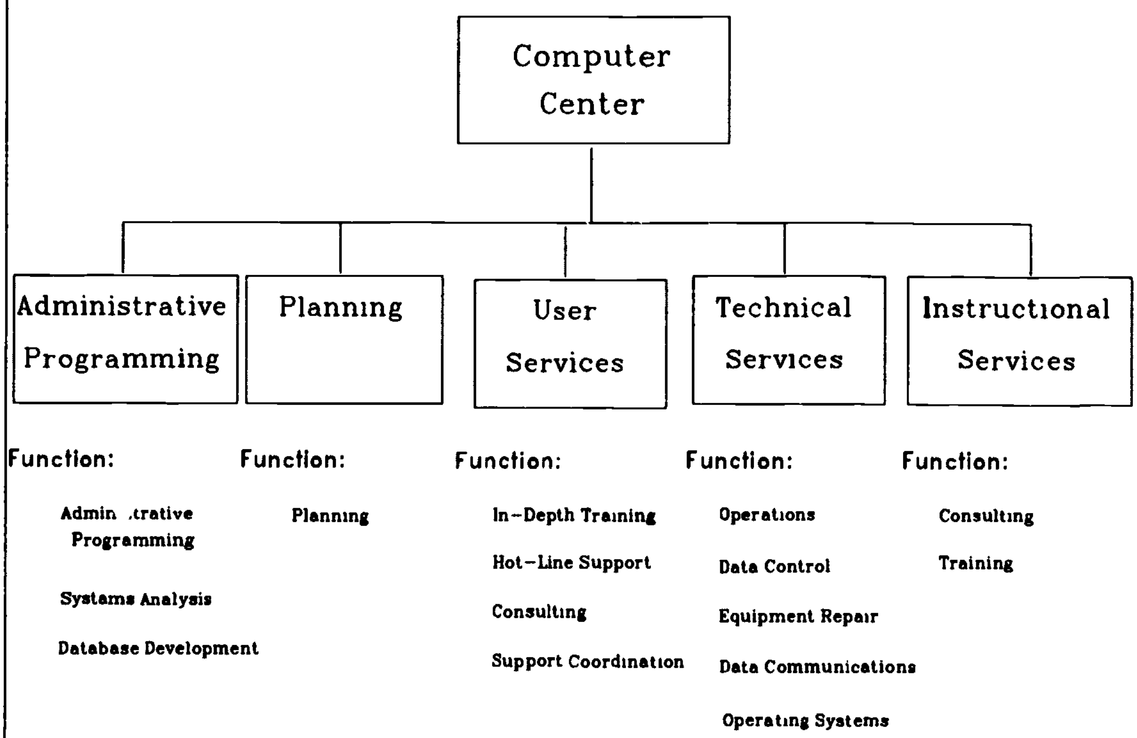

Table 2

An important organizational decision is: what will be the most efficient, cost-effective way to meet users needs. Typically, there is sufficient expertise in existing staff to make it possible to create and support this function. Generally, the initial functions of user services deals with training and consulting; which is why user services often starts as an extension of instructional support.

The problem with most university environments is that the needs exist long before the computer center can evolve a support structure. Consequently, instructional support (either gladly or begrudgingly, depending on the personnel involved) initially take on these new users. And then calls for help and resources later. Clearly, installation becomes an issue very early in this process, while the users may take awhile to express needs for data base systems and mainframe access. However, the problems of coordination are the same for consulting, training, installation, maintenance, and administrative programming: from the user's perspective somebody needs to be in charge.

Consequently, one of the major organizational issues for user services comes to this: user services must provide the focus for all the user's needs even if the expertise are in other organizational units within the computer center. Specifically, no matter what the organizational chart looks like, it is the PRIME role of this unit to make sure that the user's needs are met. Generally, user services staff will be able to provide the training and consulting role while the remaining functions (installation, maintenance, data bases and mainframe access) are supported by other computer center organizational units. The user must be the focus for the organization. The user must perceive that he/she has some<u>one</u> to contact to have all their problems resolved. It is the role of user services to FIND the answer, have the right person respond to the user, and then follow through to make sure the user has been helped.

The problems that the computer center are likely to encounter involve a clear understanding of how the internal organizational units are to interact and cooperate to resolve user problems. The typical kinds of problems that involve several areas:

-- my workstation has access to the mainframe and I can't get the data to download to my machine

-- my graduate student developed a data base in RBase for me and it suddenly won't work

-- I think my workstation is on a network and I can't login (but my neighbor can and she is, I think, on the same network)

-- we're running an application that your programming staff wrote for us but since the operating system upgrade it sometimes "crashes"

In fact the answer to all these problems are the same: the user knows who to contact (user services) and the user services staff member knows who to talk to in order to resolve the problem. While this sounds like an easy answer, the responsibility of carrying through on resolving these problems is a significant time and logistics resource.

V. Role of User Services

The earlier the computer center gets involved in planning for office automation and user services needs the better. If users can be clearly shown the pros and cons of various types of systems and told the consequences of choosing one system over another, an invaluable service will be provided and the university will benefit.

One of the major choices is a stand-alone versus a networked or clustered system. Networks have their up sides and their downs. Local area networks are easier to manage than stand-alone systems since fewer hard disks and fewer copies of the operating systems are supported. However, networks can be restrictive and slower than

stand-alone systems. If the users and managers clearly understand these issues going in, there will be fewer surprises and disappointments later on. However, even if a stand-alone system is chosen, it still it needs to be connected to the campus data network for access to the mainframe and other resources.

The need for an organized and thorough training program is greater than ever. Since training staff does not generally grow at the same rate as the user community, a method of streamlining support for this ever growing user base is necessary A goal of user services should be to use training, consulting and hot line support as methods to increase user independence. The training program should be highly structured, and contain regularly scheduled follow up sessions that reinforce learning and add new materials. A complete training program includes not only the technical aspects of using the system, word processing, and spreadsheets, but also the system capabilities. These should include: databases, electronic mail, desktop publishing, etc. In the training process, the concepts of computing must be taught along with all of the "how to" information. Teaching the concepts of computing to a largely non-technical group is a tremendous challenge for an often very technical computer center staff.

The consultative process can anticipate future problems and find ways to avoid them by customizing the user interface system, restructuring training, or even selecting different hardware or software. It is in these ways that consulting and training go hand in hand. A good consulting program will also save the "drop outs" that give up when they first run into trouble.

A "Hot Line" type of support is absolutely necessary when implementing user services. New users need rapid response to their questions to keep frustration to a minimum. In addition, point out weaknesses in documentation and training and suggest areas for improvement. One of the problems with "hot line" service is that it requires continual staff availability and in-depth understanding of the applications they are supporting. A major benefit of a "Hot Line" is that it provides continual feedback about what is working and what is not. Users learn applications more rapidly and develop more independence when all these programs are put in place.

VI. Management Issues

The first management problem is, of course, the organization itself. As has been discussed earlier, the organization is going to have to change, both on paper and in attitude. While several possible organizational options were suggested, it is recommended that personalities, attitudes, and expertise are the essential ingredients in devising a management strategy to include user services. One of the more difficult problems for user services is the coordination amongst the separate areas of the computer center. One solution to this coordination issue is to place a single manager over most areas (e.g. user services, equipment maintenance and installation, instructional support, and data communications). In this way the coordination that is required is provided by a single manager.

The "normal" route to establishing user services is to initially use instructional staff to provide the training and consulting. And, in some organizations, the mix of instructional staff and user services staff under a single manager could easily be the best permanent solution. The actual staff size varies somewhat based upon the technology being supported since stand alone workstations are more time consuming to support than are clustered environments with a single hard disk server. However, the basic training and consulting services are essentially independent of the technology. Generally experience indicates that one consultant is required for every 100 to 150 workstations in an office automation environment; and one consultant is needed for approximately every

200 to 250 faculty workstations. If equipment is installed, cabled and maintained by in-house personnel, one technician is required for every 250 workstations.

It should be clear that user services and the related support issues are resource intensive and require staffing and equipment maintenance funding. A computer center that embarks on this mission must understand that sooner or later the campus will demand to know why computing support is getting so expensive. It was once thought that as decentralization increased, the size and budget of a centralized computer center would decrease. However, decentralization has resulted in quite the opposite reaction on most campuses: as computing has become more pervasive, it is the computer center that is looked to for support. As the university computing budget expands, accountability becomes increasingly important. Let us be clear here: in order to do the job, record keeping is essential. Records should be maintained that describe who was trained and how many hours of training were offered, the number of consulting requests and staff responsiveness to them, and equipment installation and maintenance requests and staff responsiveness to them. It is also nice that this record keeping can provide the accountability that the administration or some campus committee will eventually insist upon.

Needless to say, the other element necessary for accountability is the existence of clearly defined procedures for all types of user services support. At a minimum, procedures should exist for training schedules and standards, consulting availability, software standards, hardware standards, equipment installation scheduling, and equipment maintenance responsiveness.

Finally, a campus should recognize from the outset that the services discussed here are expensive. Any campus beginning this journey will want to be certain that their administration understand the commitment it is making when it decides to bring the resources of user services to campus.

Track V
Impact of Departmental Computing

Coordinator:
Barry Kaufman
City University of New York

The maturing of information technologies has had a significant impact on academic and administrative computing. So-called departmental machines, either stand-alone or networked, are used by academic departments to instruct in a variety of applications and techniques. Having those machines has encouraged the development of distributive processing on the administrative side. In this track, departmental end users discuss their experiences and strategies.

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An Approach to Departmental Computing Support

by

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Abstract:

As departmental administrators become more and more sophisticated in their adaptation of the many rapidly emerging technologies (i.e., desk top processors and other workstations, networks and other communication paths, decision support and other analytical software), there is a rising demand for direct access to the data that is kept in central databases. Many of our universities and colleges are finding ways to provide this access and to reap the benefits of the resulting productivity. This paper is focused on development and implementation issues including strategies for support and delivery of services to departmental administrators, faculty, and students throughout Stanford University. The paper does extract and generalize on some of the lessons learned from the research as well as the project themselves. Examples are drawn from technologies now in place and from work currently in process at Stanford.

An Approach to Departmental Computing Support

Introduction

The following was written by the Administrative Services Manager of the Department of Biological Sciences at Stanford in response to a request for some supporting examples of the needs of decentralized departments for automated assistance (and was included in a planning and budget proposal for departmental support):

> In October, 1987, the Department of Biological Sciences' administrative offices were crawling with many of its 90+ Ph.D. students. Their concerns were not insignificant. It was the infamous period we now refer to as the **I-90 Siege**.
>
> Word had spread quickly among the students that some *were not being paid*. Their "Ayatollah" spokesperson wanted to *hear about it* and distributed a flyer inviting them to outline their 'paperwork' problems.
>
>> *Getting a salary around here is often a privilege bestowed only upon those who wade through 10 miles of red tape, hassle, and confusion to find out where their paycheck bogged down*, begins the flyer. It ends with this: *With your documented problems, however, I can try to get the biology department or the people in graduate awards to get their acts together.*
>
> Meanwhile, the staff was making polite phone calls to various destinations in Paperworkland, trying to locate the whereabouts of a single I-9 Form, an SAF, an RGA, a TAF, not to mention a Fin Form (A or B?), and find out if the correct SU-32 tax form had been submitted at the proper time. Each case seemed to be different: right here; misrouted; lost; stopped; didn't exist. We made these individual phone calls for these individual students, who, for the most part, were hovering about as much as possible. (Often there was no way to avoid trotting around the campus ourselves to make sure something was accomplished.)
>
> Needless to say, had we had access in our offices to student files on line with the answers to these multiple mysteries, we could have pulled off this administrative nightmare in a more professional, efficient, and timely manner. Give me 30 seconds and I could name several other administrative procedures that could easily be streamlined with computer access.[1]

The Environment

The foregoing summarizes in a nutshell the administrative plight of non-central departments, particularly academic departments, throughout the Univer-

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[1] *Proposal for Departmental Support -- Departmental Systems Group and A Cooperative for Linked Administrative Systems at Stanford (CLASS)*, December 1987.

sity. Does this statement typify the concerns and the attitudes of academic departmental administrators? Yes, it does! Not only is it the case that most of these departments have not had the benefits of automation support for the past couple of decades, unlike most central departments, but there are also some real differences in the day-to-day problems that each must face and, therefore, some substantial style and approach differences.

For the most part, central departments tend to be very process driven. That is because they are often organized to very efficiently handle some set of university processes (look at most financial or personnel areas for ready examples of this). These departments have a particular set of issues and problems to deal with and solve on a regular basis; they are highly focused and often very operational. And they usually have the benefit of automated support to assist them in these operational missions.

The non-central departments, however, are quite different administratively.[2] They tend to be much more a multi-function operation. They must deal with each and every one of the administrative processes that the central offices have had the opportunity to automate for themselves over the years. And they must often do it in a very interrupt-driven environment. They tend to have more of a support mission (to the faculty and students and the academic mission) than an operational one. And, almost without exception, they manage all this without any automated support, except that which they have managed to create for themselves on local processors.

Departmental administrators tell us that their office work is predominately paper-based, manual and labor intensive. It is also exceedingly stressful and redundant.[3] They have begun to glimpse the possibilities of the future and want their work to be much more workstation oriented and network-based. They believe that they will be able to focus more on the quality and service aspects of their support role and that, as a result, it will be more fulfilling.

The Beginning

The Information Resources organization at Stanford has two strategic goals which articulate its vision of the future: 1) to facilitate data access by providing and ensuring universal access to institutional information and by collecting data only once and as close to the source as possible 2) and to optimize the use of University resources through the integration of academic and administrative computing, library technology, and networking and telecommunications services.

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[2]Of course, academic departments can tend to be very focused on the research and instruction related to their particular disciplines.

[3]It is not just redundant within the particular office, but also when compared to other jobs, particularly those in the central departments. Often data that must be handled in the department is handled again and again by others as it is makes its way through the University paper maze.

Several important decisions were taken early in the 1980's which positioned the University very effectively for the future. In 1980, the University began the planning for replacement of several of its key administrative systems (i.e., financial and accounting, student and academic, development and alumni, physical facilities, and personnel information).[4] At that time there two major administrative database systems in use at the University. It became very apparent that choices in fundamental architecture were going to be the cause of delay and, very possibly, future incompatibilities.

In 1982, after nearly a year long study, a key decision was reached: to build all future systems in a single, principle institutional database system.[5] That single decision has enabled a variety of other actions that might not have been otherwise possible. By 1983 development and implementation of the Core systems had begun.

At about the same time the University was noticing that the trickle of micro computers being brought into the environment throughout the institution was becoming a flood. A small service unit within the computing organization that had heretofore been responsible for the support of office use of electronic mail, word processors and other office automation technology was refocused into an information center called Departmental Information Services. Its mission was to develop and support local automation expertise within departments throughout the campus. By addressing itself to computer literacy (through instruction, an information resource center and a bi-weekly newsletter), direct micro computer support (though an evaluation and demonstration laboratory and consulting), and office information studies,[6] this group helped to prepare individuals and offices for the future while providing a useful, on-the-spot service.

As the use of technology grew, the demand for access to centrally-held data also grew. Many felt that if departments had widely available access to data maintained in central databases, some major gains in productivity, as well as quality and service, could be obtained. In 1986 a three year experiment called the Departmental Access Pilot Program was launched to test these ideas. In the experiment a selected set of representative departments were given access to specific databases that had been specially modified to work

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[4]These central systems are often called "Core" systems at Stanford in that they are as necessary a part of doing business as the buildings or staff.

[5]*An Examination of Administrative Data Base Alternatives at Stanford University*, December 1982. The data base system eventually selected in this process was *SPIRES*. [Note: *SPIRES* is a trademark of the Board of Trustees of the Leland Stanford Junior University.]

[6]*Departmental Office Systems, Analysis and Recommendations, 1984*, Information Technology Services, Stanford University and *Office Automation at Stanford University, 1986 Study*, Information Technology Services, Stanford University. Both reports are in the CAUSE Exchange Library.

with a newly developed common interface.[7,8] The program included central support in terms of instruction, consulting, and uncharged access to the databases. It also included access to electronic mail and other communications products. We have learned a great deal from this program (discussed later) which has served us very well as we move toward making departmental support a programmatic reality.

Outcomes From These Beginnings

The strategic outcomes from these beginnings are three: 1) most central systems and databases are in place and ready for use, 2) there is an atmosphere of acceptance and readiness to move ahead, and 3) there is a much more refined understanding of the benefits to be obtained.

Over the course of the past half decade, nearly all of the major central core systems have been designed and implemented for the central offices. And they were all built upon the same institutional database system. As a result, they were constructed with sufficient flexibility to be extended to a wider user community, as needed.

At the same time, not only have more and more departments become ready and willing to move to a more automated form of business, but there is actually a strong and growing demand for such support.[9] Over time this led to the formation of a grass-roots organization composed of administrators from academic departments and research centers who began to (a) develop and support common software for their own departmental needs (including some specialized access to centrally maintained data for downloading to departmental systems) and (b) put more and more pressure on central administrators to provide institutionally supported assistance for these endeavors.[10]

To more clearly understand the benefits and costs of this automation, it is useful to consider three different levels or perspectives -- the individ-

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[7]The term "access" is used to mean information retrieval, local reporting, data entry, and local systems interface with central data bases.

[8]This interface is called *Prism*. It was developed at Stanford in the *SPIRES* database system. The ability to have a single human interface to a wide variety of applications and databases demonstrates one of the major advantages of the "single principle institutional data base decision" described earlier.

[9]Departmental staff have become ready and willing in two senses: 1) they are more educated in the use of technology and much less computer-phobic and 2) they have become active participants in deciding what needs to be done in order to better support their particular needs. In many cases, local systems have been developed on local micro- or mini-computers.

[10]This group named itself the *Team for Improving Prooductivity at Stanford (TIPS)* as a way of sending a signal to central University administrators. It also obtained a small amount of one-time funding for two and a half years which was used for developing some of these departmentally oriented systems.

ual, the office or department, and the University.[11] As shown in Figure 1, the benefits as well as the costs accumulate as you "move" from the individual to the University level. Moreover, there is a "value-added" effect as the benefits accrue. This framework serves as a reminder of the interdependence of the individual, the office and the University -- especially with regard to automation. Let's look at what automation means at each of these levels.

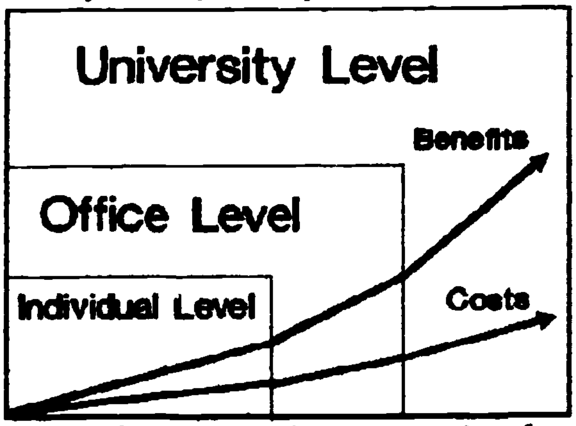

Figure 1: Automation Across Levels

At the *Individual level* it is that automation which is used to support the individual's tasks such as writing, calculation, and communication.[12] The primary benefits are to the individual and include increased productivity, "burn-out" reduction, improved quality, and improved morale and job satisfaction. Typical costs are for equipment and software, training, support, job-integration time, delays and frustration.

At the *office level* the automated functions that are added usually relate to local records management and office communications.[13] Benefits are usually more group-oriented. For example, control over staff growth, better process management, and reduced cost and time are a few benefits that can be obtained. Some costs are for additional equipment, added complexity, personnel management, more training, and additional time to adapt technology to specific tasks.

At the *University level* we typically automate additional functions such as transaction processing and information retrieval and reporting. The benefits include reduced redundant effort, time savings, error and rework reduction, and service improvements. Costs include many of those mentioned already plus central system development, operation and support.

Other Lessons Learned

In addition to the major outcomes already described, the research and these projects highlighted several other very critical themes; two of them are ***support*** and ***management***.

"Support" can be a simple word which can hide a great deal of real, and very necessary, effort and resource. As Paul Strassmann argues, the three

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[11]For a more complete treatment of this concept and these findings, see *Office Automation at Stanford University, 1986 Study* (pp. 3-').

[12]Tools such as word processing, spreadsheet software, and electronic or voice mail are obvious examples.

[13]Tools at this level are typically local databases systems, calendar support software, and local area networks (for equipment, as well as data sharing).

priorities for office automation are "Training, training, and training."[14] He makes the point even more strongly when he argues, "Substandard technology can produce satisfactory results if superior training has been given to users. However, superior equipment will not produce much if user training is deficient."[15] Training and follow up support can easily be underestimated. In this case, hundreds of staff members were trained in the use of (for many of them) unfamiliar technology. And once they were trained they continued to need ongoing support and assistance.

This training and support is all the more difficult because of the types of skills staff members are being asked to acquire. There is a popular misconception that once individuals have formal training, such as a class, they can go back to their offices and immediately be more productive. But, in fact, "Learning to use a computer is much more like taking up a musical instrument than following instructions how to use an electrical appliance such as a toaster."[16] It takes time and practice simply to become familiar with the command structures of any office information system (no matter how "user-friendly" it is). And adapting office procedures for integrating the automated system into one's work takes even more time.[17]

Pointing the finger at management has become as cliche as blaming all problems on communication. But just because these issues have been "sloganized" doesn't mean that they are any less real. We found that it was exceedingly important to have not only senior and middle management involvement but outstanding leadership, as well. The importance of the manager's role is described best by Paul Strassmann:

> In the absence of strong leadership... little success can be expected. By leadership, I mean the strong sense of purpose and a vision that the leader articulates about how the results to be obtained from the technology relate to the real purpose of the business. If such leadership is lacking the whole point of the venture will become muddled... All successful computer technology projects are carried on the shoulders of a handful of enthusiastic and dedicated operating managers (rather than technical experts), who can articulate what the fundamental objectives of the system are.[18]

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[14]Paul Strassmann, *Information Payoff: The Transformation of Work in the Electronic Age* (New York: The Free Press, 1985), p. 60.

[15]Strassmann, pp. 60-61.

[16]Charles Rubin, "Some People Should Be Afraid of Computers," *Personal Computing*, August 1983.

[17]*Office Automation at Stanford University, 1986 Study*, p. 18.

[18]Strassmann, pp. 46-47.

And, of course, in a consensus-driven environment like Stanford, it is equally important to develop committee structures which give all parties an opportunity to participate in the process. Even though many tend to snicker at these bodies as more time-sinks than results-oriented, the overall positive effect was to uncover many problems before they became extremely expensive to correct. They also served to bring staff from central and non-central departments together; this had its own very beneficial effect above and beyond systems development.

Today and Tomorrow

Now, having prepared, having studied, having experimented, having assessed the outcomes, what is next? What is Stanford doing with the lessons it has learned? The answer is that it is moving forward in three different, but related major efforts: 1) the Departmental Systems Group, 2) the Cooperative for Linked Administrative Systems at Stanford (CLASS), and 3) Folio.

The Departmental Systems Group provides a dedicated resource to academic departments as well as schools and independent laboratories for the development of local systems. It will provide business systems analysis, applications development and maintenance support. In effect, it institutionally enfranchises the departments in terms of information technology. This group, which is governed by a management coalition of schools and academic departments (an outgrowth of the *TIPS* organization mentioned earlier) is in the process of being created now. A manager has been hired, three-year plans are being finalized, and hiring of additional staff members is actively underway.

The CLASS program is intended to link department and central processes and systems. It delivers and extends the products that were being experimented with during the Departmental Access Pilot Program described earlier. In addition, it is tightly connected to the Departmental Systems Group (reporting to the same director within Information Resources). Specifically, it will provide over 1,200 administrative and support staff with access to institutional information, decentralized transaction capture and management information capabilities over the next three years. It provides the start up training and support to those administrators and their management, some portion of the equipment and communication connections, and builds the necessary linkages between local and central systems. The program is fully staffed and has been delivering these services to the first 350 administrators to enter the program since September 1988.

Folio is designed to provide access to Stanford academic and institutional data resources. It is oriented more toward the delivery of this access to faculty and students.[1] Typical files under Folio include the Harvard Business Review index and abstracts, graduate fellowships and scholarships, bookstore holdings, faculty interests, off-campus housing and about 18 others.

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[1] Whereas CLASS is much more focused on the delivery of access to institutional information for faculty and staff. The Departmental Systems Group is also focused on supporting faculty and staff but supports access to information about the department itself.

Probably most important is the round-the-clock access to the catalog of Stanford's library.

The big payoffs from this effort have been the beginning of the realization of universal access to institutional information, improved management a the departmental level, and improved integration of the administrative function. Given proper information, tools, training, and central support departments are better able to manage themselves. They have improved ability to track and access information (without mediation by central organizations). Information is more timely and accurate because it is transmitted and stored electronically. The integrity of the data is much higher, since it is entered only once as close to the source as possible. And because the number of times information is typed, handled, filed and mailed is reduced, redundant information is reduced. In addition, departments are able to manipulate their own data (using a combination of central and local tools).

How these technologies will impact productivity and quality of work at Stanford depends in large measure upon the role managers throughout the institution play in their development. The opportunities seem nearly boundless. Indeed, as Curley and Pyburn argue:

> "The real advantage of these technologies is that they can encourage fundamental changes in the way that clericals, managers, and professionals work. If managed properly, such changes can dramatically improve the productivity of the entire firm. Managers must envision how technology might be used, and then provide the framework and leadership necessary to use it effectively."[20]

[20]Curley and Pyburn, p. 32.

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DEANS - A Fully Integrated Academic Network System

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In the summer of 1987, the University of Maryland at College Park embarked on the implementation of a distributed student advising system on an academic TCP/IP network. The impetus for this project was born out of the success of a PC-based advisement system developed fifteen months earlier. Eighteen VAX 2000 workstations resident in all college offices serve as the backbone of the system, which goes by the acronym of DEANS. The users of the system were not for the most part sophisticated computer types, and thus we were faced immediately with the creation of a friendly interface to the underlying UNIX software. The interface evolved rapidly, under user pressure, into a system that provides electronic mail, document transfer, access to a variety of information on the campus, and a powerful advising tool.

DEANS

INTRODUCTION

The University of Maryland College Park campus is comprised of 14 colleges and schools with a total undergraduate population of approximately 28,000 students. The sizes of the colleges range from 500 to 7,000 students. There are 120 programs that lead to the bachelor's degree.

Three years ago a small group of individuals on the campus embarked on an experiment to use PC's using student data downloaded from the administrative mainframe to enhance student advising. During the ensuing months the system grew and began to gain recognition among the colleges as a very useful tool. This recognition drew the support of the Vice-Chancellor for Academic Affairs, who moved to fund a project that would provide each college with a multi-user workstation linked together by the campus Ethernet network.

What started three years ago as an attempt to capitalize on the emerging micro-computer technology for the purposes of student advisement has today evolved into a fully integrated academic network system known as DEANS. The system not only provides a powerful advising tool for colleges and academic departments, but also links all the colleges and academic support units via the campus network, providing electronic mail, document transfer, and a variety of other services on different computers.

This paper will describe DEANS. It will also discuss ADVISE, which has been the driving force behind DEANS, and will address those issues that had to be considered when implementing both systems.

COMPUTING ENVIRONMENT AT COLLEGE PARK

Before embarking on a description of DEANS and ADVISE, the authors feel that it is important to describe the computing environment at College Park.

There are two computer centers on the campus: a Computer Science Center, which supports the academic community for instruction and research; and an Administrative Computer Center, which supports functions such as payroll, personnel, and the administrative side of student services.

The Computer Science Center hosts a variety of hardware, including a Unisys 1100/92, IBM models 3081, 4381, and 4341, a CINCOM VAX 11/785, and a number of VAXes that provide access to other computers throughout the campus, as well as the outside (such as the CRAY supercomputer at the San Diego Supercomputer Center). The Computer Science Center also maintains the campus Ethernet network.

The Administrative Computer Center houses two HP 70 machines, a Unisys 1170, and an IBM 3090. The Unisys and HP machines are not connected to the Ethernet network.

Currently, the campus is in the process of migrating all applications on these two machines to the IBM.

Throughout the campus one also finds a variety of micro- and mini-computers from manufacturers such as Apple, DEC, IBM, Sun, Zenith, and others. For it to be successful, any campus-wide software must recognize such a multi-vendor environment.

ADVISE AND DEANS

Prior to the development of ADVISE, much of the advisor's time involved paper record-keeping and time-consuming analysis of a student's transcript. In the fall of 1985, the office of Records and Registrations approved access to student data by the College of Life Sciences to develop a computerized advising system on the college's micro-computer. While the college developed the advising system, the office of Academic Data Systems developed the mechanism for extracting and downloading the student information from the Unisys 1170. The initial success of this pilot program was such that the system was made available to all the other colleges.

When ADVISE was first introduced to the campus in the spring of 1986, it was written in C on an Altos 986 with a XENIX operating system. The pertinent data was extracted from the Unisys at the Administrative Computer Center and transferred via 9-track tapes to the Academic Computer Center, from which it was downloaded to the Altos using KERMIT.

The appeal of a microcomputer-based advisement system was tempered by the unfamiliarity of both the host machine and its operating system. In addition, the download times were enormous for anything but the smallest colleges.

The system was quickly converted to a IBM PC environment. The data tapes were now read on a PC tape drive, and the student data converted to the ADVISE format before being delivered to each participating college on floppy disks, which were then copied to the PC's hard disk. The process, which then served about half of the colleges on the campus, required 3 days of processing time and was repeated every two weeks. This mechanical method of downloading involving magnetic tape is still used today and is necessitated by the lack of a high speed network link to the Unisys. However, the advisement data is now downloaded to all colleges over the campus network in seconds. When the student information system is migrated to the IBM 3090, the data will be downloaded directly from that machine via the campus Ethernet network.

The ADVISE software is written in C, and thus lends itself to running on a UNIX as well as MS-DOS machines. Hence, in the fall of 1986 when the Vice-Chancellor for Academic Affairs committed to fund hardware acquisition for the implementation of ADVISE at every college, the recommended configuration was that of multi-user workstations running UNIX and linked together via the campus Ethernet network rather than stand-alone PC's. The Computer Science Center joined Robert Munn, author of the ADVISE software, and Academic Data Systems, distributor of the data, in implementing the network to support ADVISE.

The emerging system adopted the acronym of DEANS for Deans Electronic Academic Network System. Because of its inter-campus connectivity, the system not only offers a powerful advising tool for colleges and academic departments, but also provides full electronic mail and document transfer capabilities, and access to a variety of computerized information on the campus, including the faculty/staff phone book.

DEANS consists of 18 VAX 2000 stations resident at each of the 14 colleges plus several academic offices. All VAX 2000's run ULTRIX 2.2, have 6 Mbytes of memory, a 70 Mbyte hard disk, an Apple Laserwriter, and an Ethernet controller which links each VAX station to the campus broadband Ethernet. Each college provides its own local area Ethernet, thus giving all participants access to information anywhere on the network.

A Microvax II at the office of Academic Data Systems serves as the hub machine from which data and software is delivered to all the DEANS machines. Thus, software maintenance is done remotely from a central site and all machines have identical software. Colleges are not allowed to load their own software on the VAX'es. Requests for changes and operational considerations are overseen by a small policy group which meets monthly.

Figure 1 shows the DEANS configuration. The Computer Science Center supports the campus network and telecommunication needs for DEANS, maintains the system software on all VAX stations, troubleshoots hardware-related issues, and coordinates maintenance. Robert Munn supports the DEANS and ADVISE software and works closely with the Office of Academic Data Systems, which is responsible for direct user support and training, distribution of DEANS/ADVISE software and student data, and coordination of all activities through a DEANS Project Manager.

A powerful software interface written in C utilizes standard ULTRIX/UNIX software to perform tasks while hiding the details from the unsophisticated user, making all features of the system menu-driven. Recognizing the multi-vendor computing environment on the campus, great care was taken to make this interface available to users with a variety of terminal devices. Currently, users access the system via dumb terminals, IBM-compatible PC's, Apple MacIntoshes, and VAX workstation displays. The novice or casual non-technical user can learn to use the system quickly without knowing one UNIX command. Yet the system gives the more technical user access to all features of the operating system. On-line help screens are available to support every DEANS and ADVISE activity.

The DEANS software uses an access file to keep track of all users of the system. This file includes the name of the college VAX station, the user's full name, the electronic mail address name, and the user's access method (terminal or PC). Non-DEANS users may also be entered in this table to record their e-mail addresses. Thus, electronic mail and document transfer requires a minimum of information - the user only needs to know the name of the user at the receiving end, and the software provides all the necessary connectivity.

The system also keeps track of file transfers and automatically informs the recipient by electronic mail. In short, it is very easy to perform PC to PC transfer of files such as spreadsheets and word processing documents in a manner that is transparent to the user.

The ADVISE system is accessible from within DEANS. Each college VAX houses that college's student records, which get updated every two weeks from the mainframe. In

addition to having full advising capabilities within their own VAX 2000 (college ADVISE), college personnel are also able to access any current student record on a central Microvax II and have transcripts or audits mailed to their own VAX'es electronically (campus ADVISE).

As the ADVISE system was being developed, and later during the development of DEANS, there were certain issues that had to be examined. These issues included security, frequency of download, and system features.

SECURITY

Entry into DEANS requires a login ID and a password. Users have the option of encrypting transmitted documents, as well as turning read/write access on and off for their saved mail and other files. Not all users of DEANS have access to ADVISE. Some users use DEANS only for electronic mail, document transfer, and other non-advising utilities.

Access to college ADVISE is protected by individualized passwords. Campus ADVISE access requires two passwords: a system wide password, which is changed monthly, and the user's home machine password. An audit trail is created for all accesses to campus ADVISE.

Additionally, the student data is kept encrypted, and is only decrypted when displayed. Thus, attempts to look at the data outside of the ADVISE system will only yield gibberish.

Nevertheless, there were strong concerns about unauthorized access to, and use of, the data. It was felt that passwords and encryption needed to be supplemented by security of a physical nature to protect not only the data, but the equipment that housed it.

The Office of Records and Registrations worked with Academic Data Systems and the Vice-Chancellor for Academic Affairs in defining security guidelines. The result was the implementation of a set of conditions to which a college and any other unit using DEANS/ADVISE had to agree. The highlights of this agreement include:

1. The VAX and any PC accessing ADVISE must be dedicated to administrative functions only.

2. All staff and student employees with authorized access to the data must sign statements indicating that they will treat the data confidentially and professionally.

3. Passwords, login procedures, etc. must be kept confidential, and the equipment must be located in a room that can be locked when staff is not present.

4. The student data must be used only for advisement and the support of internal college/departmental functions. All official requests for verification of university records must be referred to the office of Records and Registrations.

SYSTEM FEATURES

During the design and development of ADVISE, there were certain goals that were identified by its designers. These goals were achieved when ADVISE was implemented, and later carried over to DEANS:

1. **USER-FRIENDLY OPERATION**
   The end-user does not need to know any operating system commands to operate either DEANS or ADVISE, as both systems are completely menu-driven. The screens are aesthetically simple, avoiding unnecessary information or jargon. The user can concentrate on his/her work, rather than the operation of the computer.

2. **SPEED**
   Screen navigation is quick. Access to individual student records is fast. ADVISE uses the student number as an access key, which is hashed to access a disk-based index. The student database thus requires minimal memory and disk space.

3. **SELF-SUFFICIENCY**
   The end-user is able to work entirely within DEANS to access all of its features, including the ability to connect to other computer systems on or off campus.

4. **FLEXIBILITY AND PORTABILITY**
   DEANS does not make use of function keys, or special screen protocols. Thus, it can be run on any simple terminal or PC. ADVISE runs successfully standalone on any MS-DOS system as well as on a UNIX-based system.

5. **SECURITY**
   As discussed earlier, the system is secure from casual browsers trying to access information. Student data is encoded at all times; decoding takes place only at the time when the information is displayed.

6. **DOCUMENTATION AND SELF-HELP**
   Good user documentation, with examples, is available in machine-readable format. Additionally, both DEANS and ADVISE have extensive online help features that the user can invoke anytime.

7. **COMMUNICATIONS AND MAINTENANCE**
   The process of systems maintenance makes extensive use of electronic mail which is automatically generated when problems occur. Exceptions save relevant files for later problem diagnosis.

The next section provides a brief description of all the main features that DEANS and ADVISE make available.

DEANS FEATURES

Below is a highlight of all the features offered by DEANS:

1. **Electronic Mail**
   This feature allows the user to read and send mail, identify any DEANS users and his/her identification, and create mail aliases for a group of users. The program frontends the machine-resident mail system (Extended Berkeley Mail) with an editor (microEMACS) for composing mail, as well as sending files. It also provides access to the campus' faculty and staff phone book entries.

2. **Access to ADVISE and Academic Data**
   This feature provides access to college ADVISE, campus ADVISE, and seat enrollment status in all course sections.

3. **Document Transfer**
   This feature allows the user to transfer documents between VAX'es and PC's, and retrieve transmitted documents. Auto-encryption is provided for sensitive material.

4. **Access Other Computer Systems**
   This feature gives the user the capability to connect to any computer on or off campus that is accessible via the network. In particularly, it allows the download and upload of files between a PC and the IBM 3090 at the Administrative Computer Center.

5. **Information Vehicle**
   The system serves as a vehicle for distributing and making information available throughout the campus. Examples of such information include the faculty/staff phone book, proposed curriculum changes, and all academic audit files (described under **ADVISE FEATURES**).

6. **Utilities**
   DEANS provides access to many UNIX utilities, among which are:

   a. Change the user login password.
   b. Change file access status to restrict reading or modifying of personal files.
   c. Set an alarm to remind the user when he/she should leave for a meeting.
   d. Remind the user of future events or meetings; the system will mail electronically reminders which increase in frequency as the event date approaches.
   e. Talk to another user that is logged on via the split-screen UNIX 'talk' utility.
   f. List, edit view, print, delete, rename, and copy files.

7. **Access to operating system (ULTRIX).**

ADVISE FEATURES

Below is a discussion of the primary features of ADVISE:

1. **Viewing Student Records**
   ADVISE provides access to all student transcript information on screen and paper. Student data may be retrieved individually by student ID number, or selectively from a file of student ID numbers. A name search capability is also available. The data displayed consists of personal/demographic, academic summary, historic and current course, and transfer credit information. Courses taken at the University of Maryland may be displayed in three formats: chronologically by semester, grouped by subject matter, and grouped by grade received. A summary display of the above three formats is also available.

2. **Electronic Notes**
   The system offers the advisor the ability to enter notes about a student. The notes are date and time-stamped. There are two types of notes: public notes may be accessed by any advisor on the system; private notes may be read only by the advisor that inserted them. Notes are not stored in the same database as the student data, and thus are not destroyed when the database is updated every two weeks.

3. **Extended Search**
   A powerful feature of ADVISE is the ability to search the student database interactively to identify students with common characteristics. In combination with the mail-merge and report-writing capabilities described below, searching provides a powerful tool for reaching and reporting specific student populations. Searches are conducted using the ADVISE query language, whose commands can be issued dynamically, or saved in specially named files for repeated use.

4. **Mail-Merge and Address Labels**
   ADVISE provides the ability to generate mailing labels and letters. These are driven by a file of student ID numbers generated by a search and/or manually-created. The file may be sorted alphabetically by name, zip code, college, major, cumulative grade point average, or cumulative credits earned. The letter text read by ADVISE is nothing more than an ASCII file with merge material indicated by key words in upper case letters. The words are replaced by corresponding items from the student database. The user can also interactively define additional key words, thus allowing the use of generic letters which can be personalized at production time. Labels can be 1-up, 2-up, or 3-up. Labels and letters may be previewed on the screen prior to printing.

5. **Report-Writing**
   The report generator gives the user the ability to create customized reports from a student ID file. As with the Mail-Merge option, the file (and thus the report) may be sorted in a number of ways, and the report may be previewed on the screen prior to printing.

6. **Academic Audit**
The audit system might more appropriately be called a course classifier, as it aids the advisor in examining the advisee's academic record. The system provides a simple and flexible language for describing major requirements. Input to the academic audit process consists of the student database and the major requirements description file against which all courses are matched. Aside from the automated aspect of auditing a student's record, a significant advantage of this system is that, by encoding academic requirements in a common format, an advisor does not have to be familiar with the requirements of every major in order to give effective advise. This allows the student to explore suitable majors that satisfy career goals.

7. **Statistical Analysis**
Programs are available that use the database to produce the following summary statistics about the student population: number of students by college, by major, by class, by sex, by GPA range, by high school, and by transfer institution. It also produces a report of weighted credit hours. These statistics can be valuable in academic planning and recruitment.

8. **Management Tools**
Using the files available through DEANS and ADVISE, a number of management tools have been written that track movement of students between colleges and majors.

CONCLUSION

DEANS has been available at College Park for over a year. ADVISE has been available to the campus for over two years, first on stand-alone PC's, then as part of DEANS. Both systems have not only improved the campus' level of service to its student population and the efficiency of operation among the various academic units, but they have also awakened the campus' consciousness to the use of new technology and have been a driving force in expanding computer connectivity among offices, whether academic or administrative.

A user's group meets monthly and serves as a forum for exchanging ideas, discussing problems, and announcing enhancements. It is expected that the system and the capabilities offered by the software will continue to grow during the next year in response to user demand.

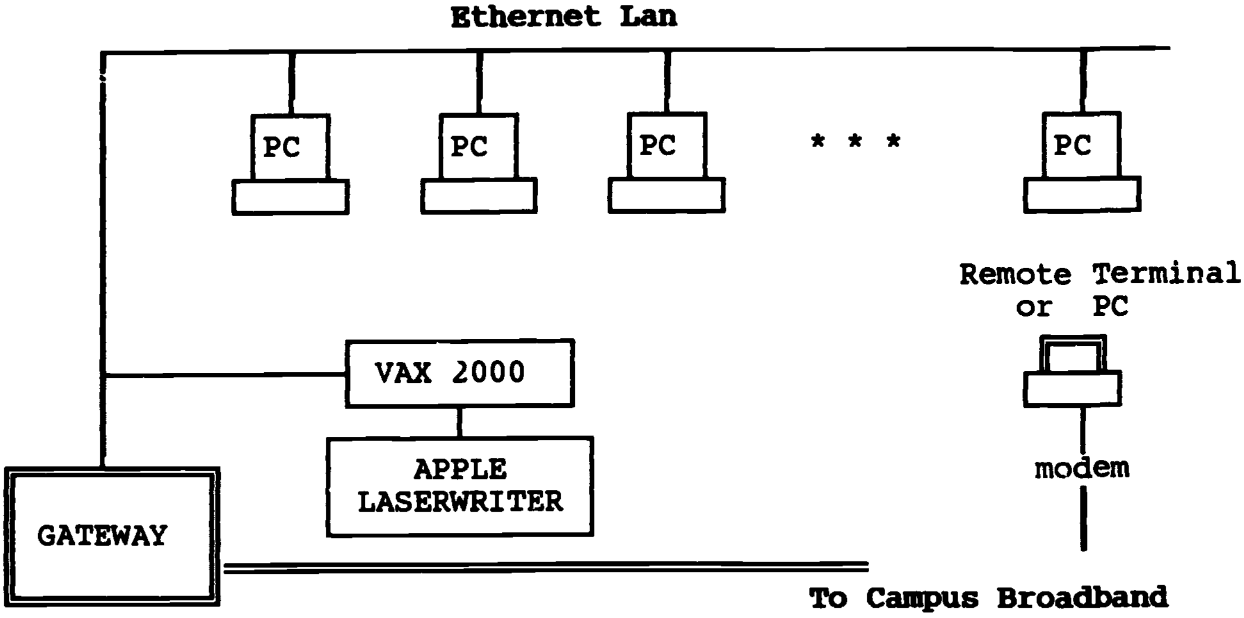

Figure 1. DEANS Configuration

Departmental Systems for Administrative Functions

A Panel Discussion

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Introduction

The University of Wisconsin - Stevens Point (UWSP) is on the bleeding edge of departmental computing. We do not have a central mainframe. We perform all administrative computing on departmental computers. Listed below are some of the larger departmental systems.

- Student Information Systems - Registration, Admissions, Financial Aid, and Housing on a HP9000/850 in the Student Life division.
- Alumni - AT&T 3B2 in the Alumni and Development office.
- Financial System - Sperry 5000/90 in Financial Operations.
- Student Accounts Receivable and Bursar - Sperry 5000/90 in the Bursars office.
- Physical Plant and Central Stores - Sperry 5000/40 in the Physical Plant office

These systems all operate in a distributed manner under the control of the operating managers of the units they support. The operating managers are responsible for all facets of computing including operations and programming.

Problems with Centralized Computing

We went to distributed computing because the central computer center did not satisfy the needs of the user. The abject failure of our computing administration pushed us to innovate and be successful at it.

Listed below are the perceived problems with centralized computing at UWSP.

- The unit was not responsive to users needs. There was a huge development backlog.
- Computing was very expensive.
- A move to on-line computing would require a massive capital investment.
- The unit was very bureaucratic.
- The unit treated some users better than others.

Departmental Applications

The key issue to user management is control. With a centralized environment, UWSP managers did not feel they had the control needed to do their job A manager with a significant computing need would bring that need to a projects committee for a share of programming resources. Once approved, development staff scheduled the project for sometime in the next six months If the need was not important enough to the committee, the manager had no recourse The environment was very political with many decisions based on clout of the requester

Computer applications requiring a high degree of integration with other applications, and are very important to the mission of the institution, make poor candidates for distributed computing. The student data base is an example of a poor candidate for departmental computing.

Applications requiring low integration and which are not important to the institution are good candidates for departmental computing. Parking is an example of an excellent candidate for departmental computing.

Between the two extremes is a large gray area. The main determining factor in selecting alternatives is the campus computer network. Campuses with excellent computer networks can use departmental computing. Organizations without a network must centralize that application.

What is Needed to Succeed with Departmental Computing

Departmental computing introduces special problems. Because the data is physically distributed, the consistency of the data is difficult to manage. Programming and human interface standards must be maintained even though computer programmers have different reporting lines.

Each new operating system, or communication protocol added to your environment makes the job of managing a departmental environment must more difficult. As an illustration of this point, with three computers, there are three different one-to-one communication possibilities. If you add one more computer, you are doubling the number of communications links to six. This a a manageable situation if you add a "standard" computer. Because you have already solved the problem of making the connection, you just have to apply the solution three times. In a heterogeneous environment, adding a new type of computer would require solving three new communication problems.

Standards become the critical issue in dealing with departmental computing. We have two operating system standards at UWSP. They are UNIX System V and MS-DOS. We can add a new UNIX computer to our network with minimal effort. This would not be true for any vendor's proprietary operating system.

UWSP is pursuing departmental computing aggressively. We have been able to offer administrative computing in a departmental manner because we have highly developed standards, and a sophisticated campus network.

Hunter College of CUNY

Hunter College

Hunter College is the largest senior college of the City University of New York Some statistics, that give one a feel for Hunter, are given in Table 2-1.

Administrative Computing

Our direction in administrative computing has been towards the establishment of a hierarchy of computing that parallels the organizational hierarchy. However, while technology advances may allow for significant computing power to be available at the lowest organizational level, the need for computing power remains constant at the higher levels. In other words, old needs don't seem to go away. Consequently, once a data base is established at some level of the nierarchy, it stays there even though subsequent data bases may be created at higher or lower levels.

Primary and Secondary Data Ownership

The effect of this little bit of acquired wisdom is to encourage us to think in terms of primary and secondary data ownership. For example, the university is the primary owner of the Personnel data base but the colleges have the capability, and are encouraged, to establish a secondary data base by duplicating whatever part of the primary data base is needed. On the other hand, the primary Student data base resides at each college and the university will select whatever parts of each college's data base it needs. Departments within each college are also creating secondary data bases from their college's primary Student data base.

This sort of structure is where Hunter is at present. This, of course, limits us to a one-way flow of data from primary sites to secondary sites. A true distributed data base, with components that are geographically dispersed, is not in our current plans. Within Hunter, we are working on co-operative processing wherein a system is distributed among several computers and communications between the system components is automated. The primary example of this is in the payroll area where each department enters their information on their own computer which is linked to the Payroll office computer.

Evolution of Administrative Computing

Tables 2-2, 2-3, and 2-4 indicate what has been happening at Hunter These tables describe the evolution of administrative computing from 1983 to 1993 in terms of organization (2-2), infrastructure (2-3), and applications (2-4). The conclusion that is implied by the evolution pictured in these charts is that Hunter College and CUNY are committed to distributed computing and that an electric approach is being taken to its implementation This approach has caused the organization, infrastructure and applications to change and will cause more change in the future in response to functional needs and technological opportunities. As always, the most significant determinant of success will be the ability of the people involved t adapt to the new roles in which they find themselves.

Description of Hunter College of CUNY

- o Largest Senior College of City University of New York.
- o Founded 1870, co-ed 1956.
- o 19,300 students of which 4000 are graduate students.
- o 2,900 faculty and staff (1600 full-time).
- o Located on four campuses in Manhattan:
  - Main- 68th st. - Four buildings, 1,500,000 sq.ft.
  - Brookdale - 25th st. Two buildings, 450,000 sq.ft.
  - Social Work - 79th st. One building,100,000 sq.ft.
  - Campus Schools - 94th st. One bldg. 180,000 sq.ft.
- o 7 academic divisions containing 45 departments.
- 0 3 research units, 15 administrative departments.

Table 2-1

ORGANIZATION

	1983	1988	1993
Hunter:	o Lack of Coordination in Administrative Technology area o New Telecommunications (Voice-Only) department reports to Business Manager o Very little high level involvement o Strong desire to move forward in Office automation o Limited Hunter Community involvement	o Administrative Technology united under AVP in one area including: o Telecommunication (Voice & data) o New Office Systems department o High-Level Policy Committee o High-Level Planning Committee o Mid-Level Implementation Committee	o Increased emphasis on partnership o Information Services concentrates on Infrastructure o Departments concentrate on Applications
CUNY:	o Strong, Central Data Processing Organization focused on technology. o Vice-Chancellor of Systems o Telecommunications delegated to Colleges	o Less of a central focus on on technology. o No Vice-Chancellor of Systems o Stronger Central Control of Administrative Systems o Telecommunications delegated to Colleges	o Increased emphasis on technology but more in office automation and networks area o Vice Chancellor ? o Strong Central control of Administrative Systems o Central Control of Telecommunications

Table 2-2

INFRASTRUCTURE

1983	1988	1993
o CUNY Commitment to IBM	o CUNY Commitment to IBM	o IBM
o CUNY Commitment to Cullinet	o CUNY Commitment to Cullinet	o Cullinet
o CUNY Network of Central Mainframes* connected to smaller mainframes at most Colleges	o Same basic structure but with upgrades and mainframes at all Colleges	o Modest growth with emphasis on networking and disk capacity
o Low-Speed Bisync Line	o Moving towards T1 lines and SNA network	o Complete SNA network with some fiber optic links
o <u>Hunter</u> has 4341-12 w/3.7 Gbytes	o <u>Hunter</u> has 4381-13 w/15.2 Gbytes	o <u>Hunter</u> has dual CPU w/50 Gbytes
o 30 terminals connected to <u>Hunter</u> 4341	o 100 terminals and 25 PCs connected to Hunter 4381	o 200 terminals and 200 PCs connected to <u>Hunter</u> CPUs
o Hunter starts installation of Main Campus PBX (Voice-Only)	o Hunter installs voice/data PBX at SSW Campus o Hunter installs data PBX at Main Campus	o Integrated voice/data Network for all five Hunter Campuses.

Table 2-3

Administrative Applications

	1983	1988	1993
Academic	o University (Institutional Research)	o University (Inst. Rsch.) o Hunter (Inst. Rsch.) o Hunter-Reports based upon SIS data base	o University (Inst. Rsch.) o Hunter (Inst. Rsch.) o Integrated College-wide Data Base o Decision Support ?
Student	o University Admissions Financial Aid o Hunter SIS	o University Admissions/ Financial Aid o Hunter SIS o Departmental Applications	o University Admissions Financial Aid o Hunter SIS o Departmental Applications
Research	o University System	o University System o Single Department System	o University system o Hunter Research Admin. o Hunter Divisional Systems
Finance	o University System	o University System o Some subsidiary systems on Hunter mainframe o Several subsidiary systems in depts.	o University System o College-Wide Data Base o Subsidiary Systems in depts.
Human Resources	o Hunter System	o University System o Subsidiary Systems in Personnel and Finance	o University System o College-Wide Data Base o Subsidiary systems in Personnel, Finance, Divisions
Facilities	o University System	o University System o Single Department System	o University System o Hunter System

Table 2-4

Virginia Tech

An Organization for Administrative Systems

Automated administrative systems have flourished at Virginia Tech since the early 1970s. The University was one of the first in higher education to have on-line, computerized systems for financial, personnel, and student activities. Realtime updating and inquiry are major features of the systems through thousands of devices for access over the communications system.

The Systems Development Department was established at Virginia Tech to provide support in the design, development, and implementation of computer-based administrative systems. For almost 20 years, most of these systems have been developed in-house using the IMS data base management system and COBOL. Unlike many other universities, once an administrative system is developed, operational responsibilities are decentralized to the major functional office. Thus, there is no centralized administrative data processing group or administrative computer.

Involvement in departmental computing and distributed activities might seem a logical consequence of having no centralized administrative data processing group at Virginia Tech. Indeed, such involvement is almost unavoidable with over 13,000 personal computers and a large number of mini-computers located around campus. However, the departmental and distributed activities are primarily associated with the instructional, research, and extension missions of the institution, and (obviously) some of the "local" administrative functions that are required to maintain an acceptable level of operation. It remains a fact that all major and "official" administrative systems at Virginia Tech are on one mainframe computer and, to a large degree, are in some form centrally controlled. Those groups located in functional offices have responsibility for the operation, maintenance, and minor enhancements of their administrative systems.

Virginia Tech has been in the business of developing and implementing administrative systems for over 20 years, and those in-house systems have generally fulfilled the needs of a diverse group of users. In recent years, new technologies have expanded the opportunities to users and altered directions for administrative systems.

Entering a New Era

Information management is entering a period of eventful change. Distributed data, distributed processing, new information delivery systems, open architectures for information systems, networking, and other technological advances will contribute to new and changing environments. Such advances are altering views on automating administrative functions and making information easily accessible. These efforts are placing increased importance on having better control of information as a university resource. Distributed technologies make it important to maintain a point of central control for ensuring support of overall institutional goals. Distributed activities should not necessarily be discouraged, but solutions created for specific areas need not, at the same time, diminish support of institutional systems.

These apparent changes prompted the Vice President for Information Systems to assign his Assistant Vice President to direct the Data Administration staff and develop a strategy for the future. The staff spent several months evaluating existing environments, discussing new and future technologies, talking with users at all levels, and trying to gain the right perspective for information resources at Virginia Tech. The result of this hard work was a document, "An Information

Infrastructure for the Future," that focused on new directions for administrative systems for Virginia Tech. (This document is available from the CAUSE Exchange Library.)

The document addressed the fact that development of administrative systems at Virginia Tech will change over the next five years through a decrease in actual development of systems and an emphasis on distributed technology, specialized software, and available third party products. As a result, the Information Resource Management Department should assume a leading role and accept new challenges to coordinate, integrate, and disseminate the "new wave" of information technology. In accepting this leading role, the department must become more involved in managing information as a university resource, and deal with issues of information identification, management, accessibility, integration, security, and planning.

A Vision of the Future

The obvious starting point for any successful venture is a clearly stated, clearly communicated vision of where the organization is going. By considering trends, and changes in technology, people, and even higher education, a vision for an information infrastructure will evolve; however, it is only a vision and it must be part of a continuous planning process.

What is the vision for administrative systems at Virginia Tech? The future information infrastructure for this institution is one that will support distributed, decentralized activities. Over the next decade, most administrative systems will be operating on computers located in major functional offices such as Accounting, Purchasing, Admissions, Registrar, and so on. This distribution will be extended to college and departmental machines that will provide more opportunities for decentralized activities.

This vision of an information infrastructure is only the first step in a long and continuous process. A participative planning process will define projects necessary to accomplish the goals and objectives of the organization. Important to the process is the inclusion of individuals who represent all phases of an information spectrum - information owners, developers, integrators, users, and support services. Many of the issues these planners will deal with are not associated with the traditional "components" of an information system, that is, hardware, software, and communications. These areas and issues must be viewed in a global sense. crossing traditional institutional boundaries to recommend directions for the future.

An Organization for Success

The process for developing and implementing administrative systems has been very structured and centralized, responding to specific and clearly defined user needs. As activities are distributed and greater responsibility is placed in operational offices, the process will become increasingly unstructured. It is extremely important to have an organization that can manage this type of environment and support the concepts of an information infrastructure.

A recent article in ComputerWorld also referred to this type of unstructured environment. The author feels that "managing information systems effectively in this increasingly unstructured environment requires an understanding of the attitudes, roles, and responsibilities of those involved."[1] The document prepared by Data Administration recommended an organization to coordinate and control efforts to move administrative systems into the future.

An Information Management Organization

Institutions must recognize the importance of an information management function. Administrative systems and information span the entire university structure and demand a high degree of coordination and integration. If information resources are to be a means for a more productive and

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[1] Halsey Frost, "Time for a Change," ComputerWorld, March 2, 1988, p. 19

effective university, then a central unit must coordinate and control many activities associated with information systems.

The information management organization that supports an information infrastructure should be positioned within the university structure so that it can easily associate with many different individuals, both internal and external to the university. The organization must be able to function well in a liaison role, to provide consultation, to be active in planning efforts, to form a clear view of the university's information requirements, and, at the same time, to enforce standards and procedures to conform to an overall strategy for information systems.

James J. Odell, a senior consultant in the field of information engineering, summarized the importance of centralization by indicating that successful data administration requires centralized control. Its functions should not be scattered among the diverse needs of programmers, analysts, users, and so on. Information is a vital university resource. Only by centralizing information management at a level appropriate to a vital resource can information truly support the university.[2]

Information Resource Management

In order to accommodate this type of organization at Virginia Tech, the Systems Development Department was moved to the C nputing Center, leaving only Data Administration in the Information Resource Management (IRM) Department. The primary mission of Information Resource Management at Virginia Tech is to provide leadership and direction for an infrastructure that supports all levels of informational needs at the institution. Through management and technical activities, IRM has primary responsibility for the planning, management, and control of information as an institutional resource. The department will capitalize on new opportunities for administrative systems and provide a variety of services to support the information infrastructure.

- Information planning at the university level
- Standard formats and naming conventions for data
- University-wide directories and dictionaries in a medium that is accessible and understandable to non-technical personnel
- Standard access methods that are available to a wide range of users, requiring little or no technical expertise to use
- A quality assurance function for data integrity and for enforcing appropriate standards and procedures
- An awareness of opportunities to enhance and expand information systems
- A methodology and level of expertise to ensure systems conform and, as required, are part of the university-level information structure
- Security at appropriate levels to enforce required restrictions as defined by data owners and/or security officers
- Overall data management assistance from the design phase to an operating environment

These IRM support services will be accomplished through activities in the following areas.

- Systems Planning and Integration
  - Global (institutional) planning
  - Information modeling
  - Information needs analysis
  - Quality Assurance Program
  - Decision Support Systems/Knowledge Based Systems

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[2] James J. Odell, "Organizational Structure for Data Administration," *DataBase Newsletter*, Volume 12, Number 6, November/December, 1984, pp. 1-4.

- Data Management
  - Metadata (directory type)
  - Data dictionary
  - Data standards
  - Documentation
- Operations and Access Control
  - Generic "service" systems
  - Security/ACF-2
  - Electronic authorization
  - Single userid and password
  - Performance
- Advanced Information Systems
  - Consistent Window project
  - Artificial Intelligence/Expert Systems
  - Advanced delivery systems
  - Departmental environments
  - Networking

These activities will require services from various IRM groups and cooperation with outside organizations such as Systems Development, Systems Programming, Internal Auditing, Institutional Research, operational offices, and others. Other services, such as data base design consultation, assistance in evaluating proprietary software, and considerations for standards, will require participation from various university departments and close coordination.

This environment can be viewed as a new housing development. A chief architect is responsible for designing the overall development and making sure community needs are met. Other architects and contractors work with the chief architect to build homes and other facilities to meet the development's needs. As with most developments, the demand continues to grow and expansion and improvements are ongoing processes.

Information demand at Virginia Tech will continue to grow and an organization such as IRM is needed to ensure an acceptable information infrastructure is present. Such an effort is not short-term in nature and requires a long-term commitment.

The Creation of an Executive On-line Decision Support System

Dr. Charles W. Burmeister
Director of Information Systems
Alamo Community College District

A system solution using integrated information technologies is been developed to provide end-users, primarily academic leaders, a full range of on-line functions including selection, ad hoc queries, data analysis, statistical analysis, report generation, and presentation. Institutional key strategic indicators are accessible for viewing or graphical presentation. An information gateway is provided to historical file structures easing access for queries and questions spanning several academic years. All activities are menu driven. The system provides substantial benefits including access to strategic indicators, to key data, to data analysis, and to the presentation to support executive decision making and planning. The system consists of a PC work station or terminal, micro-to-mainframe link, identical application software on PC and mainframe, software for integration and user friendliness, and structured historical file structures.

The Creation of an Executive On-Line Decision Support System

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__INTRODUCTION.__ "There is a widely-held perception among administrators on many campuses that the mainframe databases are holding enormous amounts of data that would be extremely useful, if only it could be accessed and manipulated in some relatively easy ways (Desktop MIS for Administrators). For the most part, computer center directors agree, making this the top choice for the hottest administrative computing issue. The mission this year is to turn the day-to-day operational data processing systems into easy-to-use, readily- accessible, information generators. Computer people are looking at applying fourth-generation languages to the data, doing extracts into relational databases, down loading into microcomputers, providing mainframe report writing and statistical analysis packages, and, increasingly, looking at whole new administrative systems that automatically (in a sense) provide the responsiveness and control that end-users want."[1]

We may disagree as to whether to reference this issue as Desktop MIS, Executive Information Systems, Decision Support Systems, Executive Support Systems, or Information Support Systems. However, we certainly agree that it is a high priority objective to turn "operational data processing systems into easy-to-use, readily-accessible, information generators." In addition, you and I would certainly place additional criteria on this concept in order to provide greater clarity and definition on this concept within our own university and college environments.

Within the Alamo Community College District (ACCD), we are developing a system to meet needs which may be unique. I will be sharing with you ACCD's approach, objectives, design, experience, and strategies. From these discussions, you may find those elements that are useful on your own campus. As you will see as the presentation unfolds, we currently refer to the system as an Information Support System due to the diverse objectives to be met by the system.

"Hot Issues 1988-89," The __EDUTECH REPORT__, September 1988, p. 1.

Further, it should be noted that the creation and maintenance of an information support system for academic administration is a migration toward a not too distant goal rather than a destination itself. Strategies appropriate for the genesis of the process must give way to other strategies as users gain experience and their needs mature. As we move closer and closer, the target, of course, constantly moves upward which maintains the challenge for our profession.

In industry and business, executive information systems have been around for some time. It was in the 1970's that Merrill Lynch, the brokerage firm, installed an EIS. EIS is one of the faster growing areas in industry and there are an abundant number of software offerings ranging in price of upwards to $250,000 depending upon options.

Within industry, there are a sufficiently large number of documented success stories to attest to the viability of the opportunity. These include Marine Midland Bank, Xerox, General Services Administration, Kraft, and Phillips 66 to mention a few The reader may refer to the book Executive Support Systems by Jack Rockart and Dave Delong of MIT's Center for Information Systems Research (CISR) for more detailed information of what has worked best in industry.

A word of caution should, however, be noted. Various elements of academic administration may be similar to the decision making of business executives, but there are sufficient differences that the temptation to make a direct extrapolation of experiences and strategies should be avoided.

In the academic area, there is at least one offering specifically developed for universities. It is offered by Information Associates and is called IA's Executive Support System. The development of this system was, I believe, directed by Charles R. Thomas, formerly executive of Cause and now Vice President of Information Associates.

To provide for continuity of thought, the following is the sequence of subjects that will be discussed. The college environment will be described along with the associated problems and opportunities; the opportunity provided by the converging of technologies; the implementation that is underway; and finally, a look at future possibilities.

THE COLLEGE ENVIRONMENT. The Alamo Community College District (ACCD) consists of three community colleges, San Antonio College, St. Philip's College, and Palo Alto College, with a total enrollment (head count) of about 32,000 students. Classes are offered at the three college sites and at four other campus centers. Personnel consist of approximately 750 full time faculty, 60 administrators, and 450 professional and classified staff.

Computer resources consist of an IBM 4381 computer for administrative computing, an IBM 4341 and an IBM 4331 computer system to support academic processing, and about 700 terminal devices located at seven distinct sites. A SNA/SDLC data communications software system is used to communicate among all the systems and a T1 communication link connects three major sites. Over 100 of the terminal devices are PC's that emulate the 3270 terminal allowing for stand alone or integrated operation.

In September 1986, a comprehensive financial software system, the College and University Financial System offered by American Management Systems, was installed. In 1988 the Student Information System offered by Information Associates was installed. Hardware was upgraded to the IBM 4381 in 1986 and the DASD system was recently, 1987 and 1988, upgraded and expanded.

Information centers were maintained for use by all personnel at three locations in the period 1984-87. Use of these centers by individual personnel was very low. However, requests for over 2000 production jobs and ad hoc management reports are received monthly and processed by the production analysts. It was in this environment that we set out to create an information support system to provide easy access by administrators to the operational databases. The project is currently underway.

INFORMATION STRATEGY. Due to converging, available technologies the opportunity for an integrated information support system was feasible. Our work and thinking began with the general idea to make information more readily available to end-users. This included end-users at all levels. We wanted there to be easy access and we wanted to expand the circle of users to include administrators and top management. The pattern that has existed within ACCD may be typical of many institutions. An ad hoc request is made. Depending on the nature of the request, how busy the production group is, and the priority placed on the request, the user may receive the ad hoc report in a few days or a few weeks depending on its complexity. A decision maker may not be encouraged by the process to make several iterations in obtaining full and complete information to support the decision process.

We also observed that our "users" by most evaluations were those who we worked most closely with in the creation and maintenance of the database, the admissions and records personnel, finance personnel, and etc.

As noted earlier, the institution had make major commitments in 1986-88 of resources to software, hardware, and communication systems. The next phase of the development should make the data conveniently available to users at all levels. This is the payoff. This is the exciting part.

It was, and is, our primary objective to create a system for end-users at all administrative levels within ACCD whereby data can be easily accessed and structured so that it will be timely, useful, meaningful, and relevant to users work. Coupled within or secondary objectives would include the desire that the data support administrative decisions, that the system would support other departmental initiatives in end-user computing, the system would expand the user base to include upper management, and that there would become one source of consistent, accurate, and reliable information.

SYSTEM DESIGN. Of the three options, PC stand alones, mini-computer systems, or integrated mainframe based systems, we have selected the integrated mainframe approach. The databases reside, of course, on the mainframe and it will allow more control and flexibility. We expect large PC workstations will ultimately exist in key locations.

To allow for ease of access and efficiency, extracts of the databases are created. The term extract is not to imply that key or important fields are not available to the user. The student information system file is created with all the unchanging, not term related, characteristics. These records total 150,000 for five years of historical records. The record length is 120 bytes. Another file with record information related to each term is 160 bytes in length. These total 225,000.

FOCUS 5.5, characterized as a 4GL language, is used to access these files, create other extracts, provide menu drivers, and produce the reports or queries. It currently is operating under CMS. FOCUS is available for mainframe as well as PC workstation use. We may also use SAS which provides products for mainframe and PC's to product certain graphics and statistical results.

IMPLEMENTATION. The system consists of three sub-systems; strategic indicators, structured data analysis, and individualized data studies.

In the strategic indicator sub-system, key information areas has been identified as strategic indicators such as student head count, contact hours, and etc. This information is stored in predefined data structures and is formatted for immediate access by the user. The user is "stepped" through menus with options and selections. The data can be plotted using various graphics options. The options available are rigid and highly structured as the information structures are predefined with the choice of the strategic indicator. The reader may argue that this is not access to data in the usual sense. However, the use will provide an important function at ACCD and is, in a sense, a "sampler" for the other two sub-systems.

The structured data analysis allows the user to select many

different variables and fields for study. The analysis may be by college, by division, by ethnic group, and etc. The user is "stepped" through menus as elements of the query is structured and as output is selected.

The individualized data analysis sub-system will allow the user "open access" to the extended data structures in the creation of a query. Files can be created for down loading to the PC workstation. The user will be guided by menus in the creation of the product.

The system is targeted for the end-user who would not be characterized as an operational end-user such as admissions and records personnel but the non-operational end-user such as deans, vice presidents, presidents, and academic managers.

FUTURE OPPORTUNITIES. Technology in this area will increase rapidly and will enhance the opportunities that exist. Data from external data bases has not been included. It is expected that as users use the system, it will evolve as the needs of the users evolve and as the users mature as users.

An accurate, valid, conclusion can be repeated from another source. "This new generation of strategic information systems represents an exciting approach to providing support to administrative decision-making and planning activities in colleges and universities... I would suggest that this new era will soon require, if it does not already, a computer based administrative strategic support system as a vital part of every institutions information management facility."[2]

[2] "Information Systems Support for Future Strategies," The EDUTECH REPORT, July 1988, pp. 1, 6-7.

INTEGRATING A DEC AND IBM ENVIRONMENT BETWEEN CAMPUSES

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Introduction

The University of Colorado like many other universities has more than one campus. While multiple campuses opened up opportunities for the university, it also presented problems. With computers these problems were quite complex. There were problems with distances between campuses, compounded by each campus having computer systems from different companies with different operating systems. This paper is a case study of how the University of Colorado at Colorado Springs integrated a Digital VAX environment with the IBM environment 100 miles away in Boulder, Colorado.

The University of Colorado at Colorado Springs, one of four campuses in the university system, did most of its administrative computing for the campus on the IBM mainframe in Boulder. Until the intercampus network was established, most of the computing was done in batch mode using RJE card readers and printers. This was replaced by IBM terminals and controllers and a spooling protocol called HASP that ran on a Digital 11/750. The IBM in Boulder was upgraded to a NAS XL-60, an IBM compatable mainframe computer. When the University decided to install an on-line student information system, an on-line Accounts Payable system, and an on-line Purchasing system,it became necessary to have a large number of users connected interactively.

Campus Network

The original local campus network was a DCA asynchronous network. When over a dozen computers in a new engineering building had to be connected to the network, options were explored. The ideal was for all users to connect to all computers in the same manner. This would allow easier support and troubleshooting. The first decision was to use ethernet to connect terminals on campus to the network. Bridge Communications CS/100 terminal servers were used to allow multiple users access from various locations on campus. The protocol used was TCP/IP. This was chosen based on its ability to connect to Unix machines and considerations for future connections to outside networks such as the Colorado Supernet and the National Science Foundation network which also uses TCP/IP. (see figure 1.0)

The campus historically has had problems with electrical storms and power fluctuations that at best stop computer equipment and at times damage this equipment. Optical fiber was run between buildings to reduce potential damage from electrical storms. Ethernet cable was run within each building. (see figure 2.0)

Intercampus Network

Initially, there were a limited number of users who had on-line capabilities through the use of IBM controllers on an SNA network connected to Boulder. These were IBM 3278 terminals connected to controllers using coaxial cable. However, this network would only support a fixed number of users and would also be too costly to use as an on-line system for a large number of users. There were several options available. First, we could have continued with the existing equipment. A few individuals had access to IBM terminals. The rest of the campus used central data entry and batch reports for their only access to computers. This was slow, it was not responsive, and was clearly not what the campus wanted. Second, additional IBM terminals and controllers could have been added. This was fairly costly, there would have been problems running enough coax cable to certain parts of campus, and it would not allow individuals to access both campus and Boulder machines with the same terminal or microcomputer. Third, asynchronous switches could be installed. This appeared to be a very costly approach and the campus was moving away from asynchronous switches toward ethernet for connecting academic computers. The fourth and final option was to use the campus ethernet. This minimized the network problems and allowed individuals to use the same terminal to access all of the computers on campus as well as the administrative computer in Boulder. The

primary disadvantage of this approach was that non-IBM terminals had to be able to work in an IBM environment. The decision was made to use the campus ethernet to allow administrative departments to connect to the administrative computer in Boulder.

When the main connection from Boulder to Colorado Springs was in the planning stages, anticipation of future growth and additional needs were taken into consideration. As a result, a 56 KB line was chosen using T1 Timeplex multiplexers on each end. This will allow the line to be upgraded to a T-1 line in the future. (see figure 3.0)

How the Intercampus Network Works

The link between the administrative computer in Boulder and terminals connected to the campus ethernet went through several steps. However connections on the Boulder end were fairly straight forward. First the channel from the T1 multiplexer feeds to an IBM front end processor which connects directly to the NAS host computer. The channel from the host computer through the T1 multiplexer in Boulder down to the T1 multiplexer in Colorado Springs was SNA.

A gateway from SNA to TCP/IP was needed to connect the SNA channel to the campus ethernet. The gateway was esta'_ished using Bridge CS/1 communication servers. Each CS/1 server supported 24 ports. Two servers were installed. The two servers increased the number of ports and provided a backup in case problems occurred with one of the servers. Complications occurred when the servers

allowed only 19 ports to connect rather than 24. Limitations in the processors appeared to be the cause. A hardware and software upgrade was needed to increase the number of ports on each server.

After the data traveled through the CS/1 gateway, it then entered the campus ethernet. CS/100 and CS/200 terminal servers were used to connect users to the CS/1 gateways. Since the host computer operated in an IBM environment, it was necessary to emulate an IBM 3270 series terminal. The users on campus had a variety of terminal types, including microcomputers serving as terminals. Since the campus had a Digital VAX environment, Digital VT220 terminals were selected. This allowed access to the administrative computer and worked well with the VAX, allowing access to both resources from the same terminal. The microcomputer situation was similar. The majority of systems on campus were Zenith microcomputers running MS-DOS. The challenge was to make these look like an IBM series 3270 terminal. The VT220 was supported by the CS/1 hardware. It was important to define function keys to cut down the number of keystrokes required to perform functions that were only one keystroke on the IBM. With the microcomputers it was necessary to first emulate a VT100 which was supported by the Bridge equipment. PC-VT was the emulation system most users were using to connect to the VAX so it was decided to use it as the emulation software. Function keys were also defined on the micros in order to shorten key sequences. Because the terminal needed to be set properly in order for the terminal to be recognized by the network, defining the terminal set-up at the time

of connection became essential. If the set-up was not correct to match the network then the terminal would lock-up. Using macros available on the terminal servers it was possible to send the correct terminal set-up to the system when the user typed in the initial login command. In this way it was possible to define different logon commands depending which terminal the person was using. The system was set-up for a PC or a VT220 depending on the logon command the user enters. The user was given a menu where they selected the terminal type they were using. After the terminal type was selected the connection was completed and the user was on-line on the system in Boulder.

This system worked well, except for one problem that occurred during the process of setting up the terminals and keyboards. The alpha-lock key function that is available on an IBM terminal that allowed the user to enter a numeric value into a alphanumeric field. This function has not been available on either the VT220 or the Zenith microcomputer. This was a problem with the software and has been reported to Bridge communications.

Conclusions

If we measure the success of the network by the willingness of the users to use new equipment, the use of VT220 terminals and microcomputers has been very successful. Given the choice of IBM terminals connected to the controllers and the use of the new network, most users will select the new network. The networks at the University of Colorado at Colorado Springs are continuing to

evolve. As this evolution takes place there will certainly be changes in the existing networks. However this network allowing users to be on-line on a computer on another campus, as well as connect to the local computers using the same terminal, has proven to be beneficial to everyone involved. In addition, the campus Ethernet network running TCP/IP with gateways to other networks outside the university should also be useful for future growth.

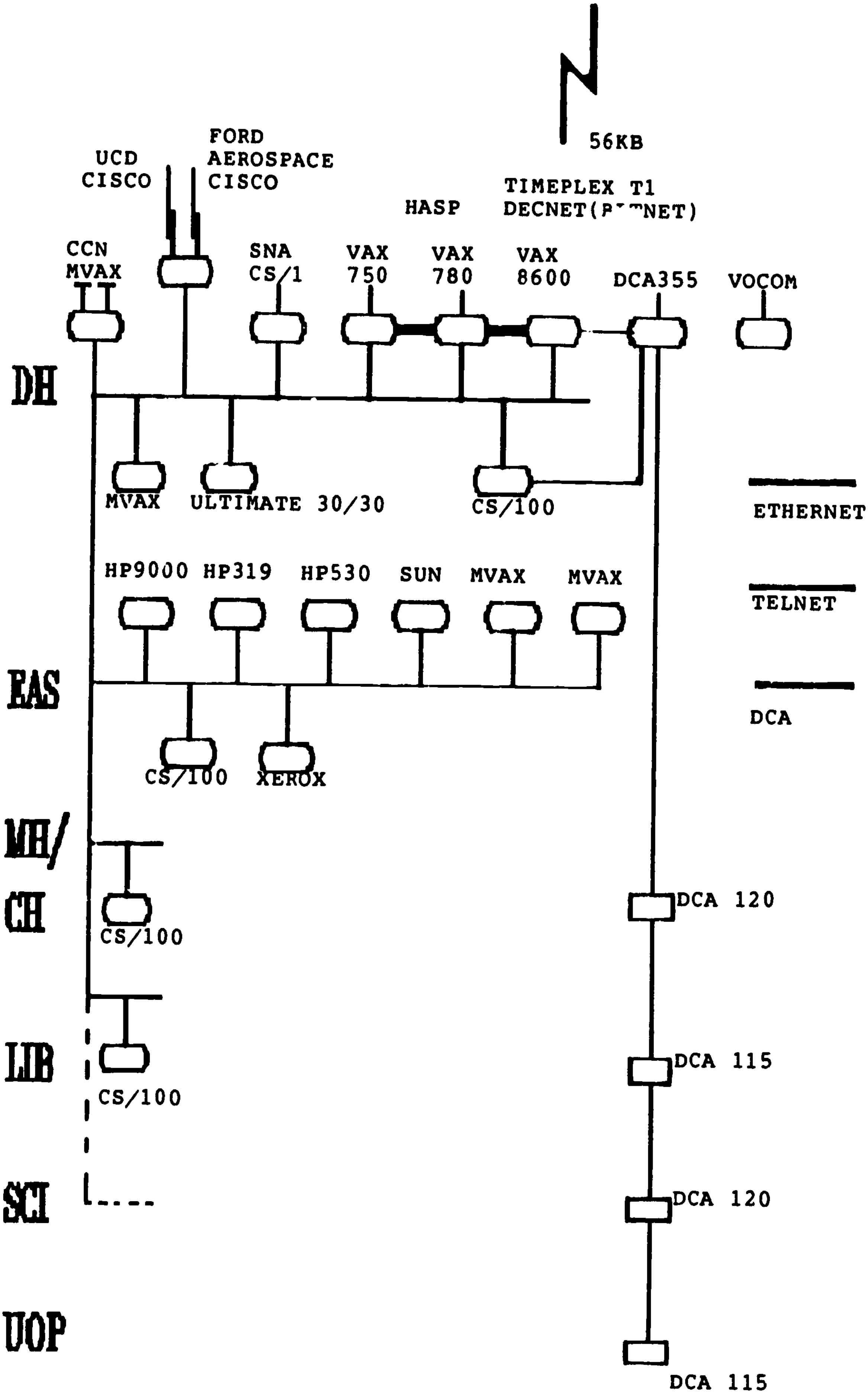
56KB
UCD
CISCO
FORD
AEROSPACE
CISCO
HASP
TIMEPLEX T1
CCN
MVAX
SNA
CS/1
VAX
750
VAX
780
VAX
8600
DCA355
VOCOM
DH
MVAX
ULTIMATE 30/30
CS/100
ETHERNET
HP9000
HP319
HP530
SUN
MVAX
MVAX
TELNET
EAS
DCA
CS/100
XEROX
MH/
CH
CS/100
DCA 120
LIB
CS/100
DCA 115
SCI
DCA 120
UOP
DCA 115

FIGURE 1.0

UNIVERSITY OF COLORADO AT COLORADO SPRINGS
CAMPUS ETHERNET

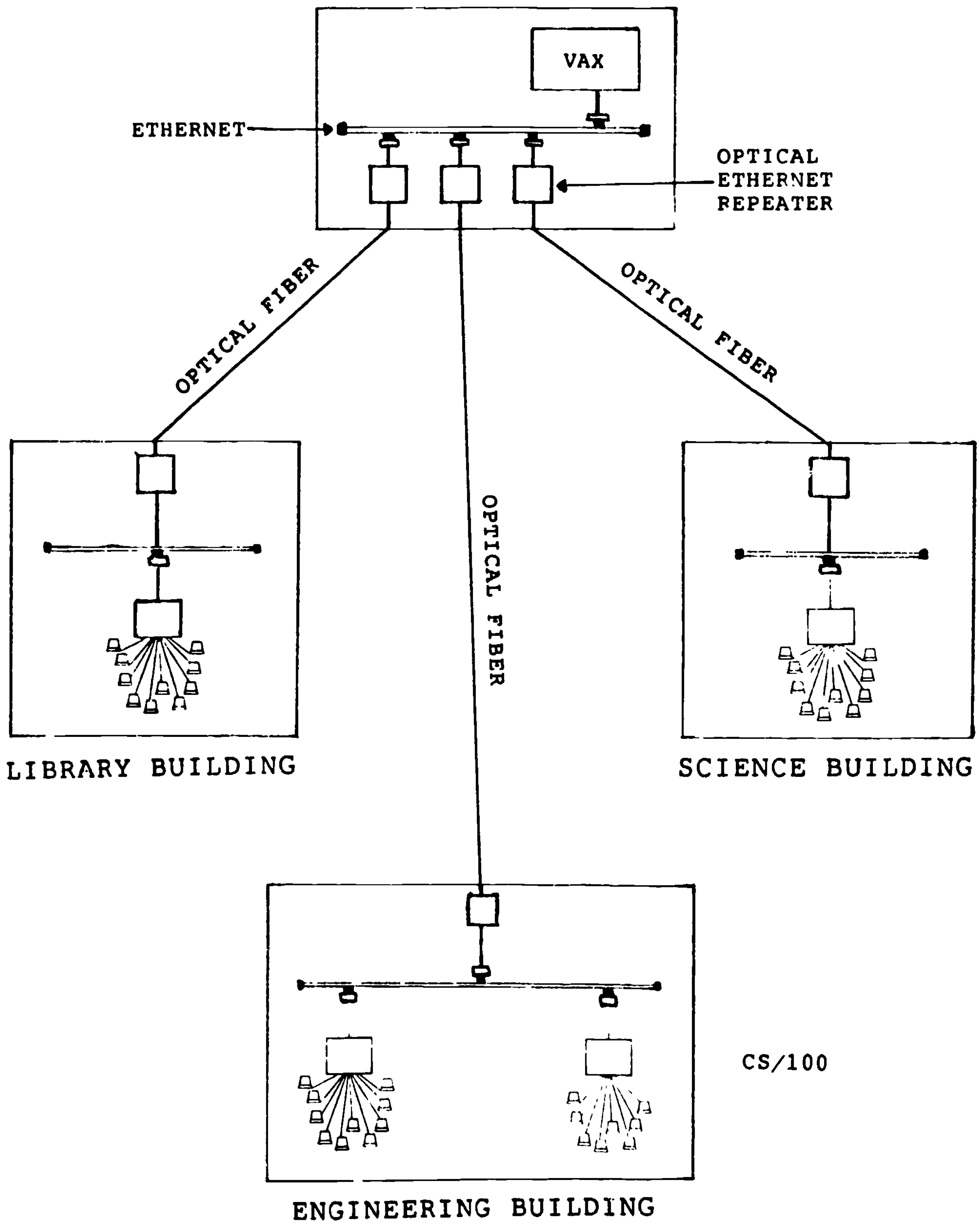

FIGURE 2.0

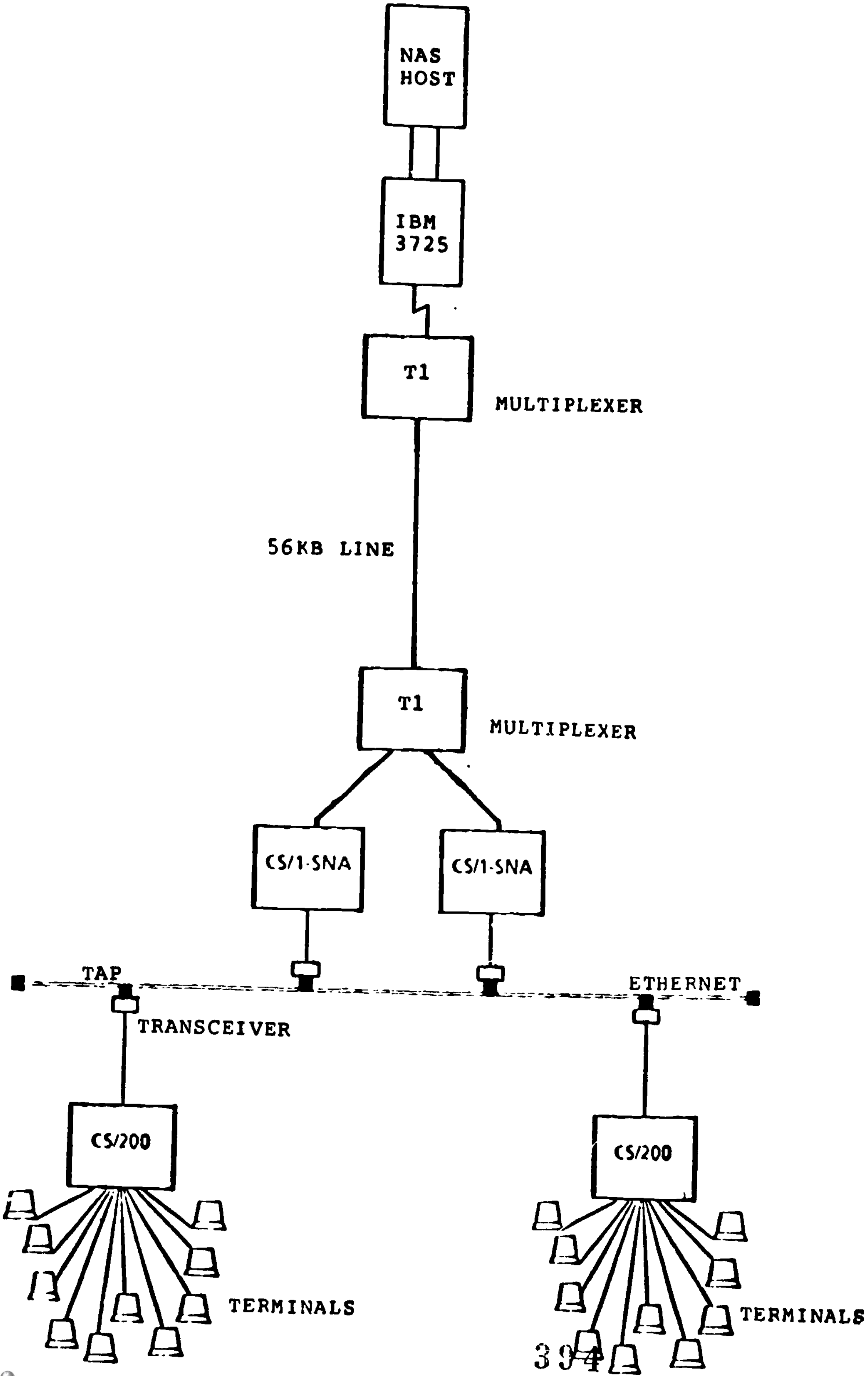
NAS HOST
IBM 3725
T1
MULTIPLEXER
56KB LINE
T1
MULTIPLEXER
CS/1-SNA
CS/1-SNA
TAP
ETHERNET
TRANSCEIVER
CS/200
CS/200
TERMINALS
TERMINALS

FIGURE 3.0

Bridging the Gap between the Data Base and User in a Distributed Environment

Richard D. Howard, North Carolina State University
Gerald W. McLaughlin, Virginia Tech
Josetta S. McLaughlin, Virginia Tech

Lennie said, "Tell how it's gonna be."

George had been listening to the distant sounds..."Look across the river, Lennie, an' I'll tell you so you can almost see it."

"Go on," said Lennie, "How's it gonna be. We gonna get a little place."

The voices came closer now. George raised the gun and listened to the voices. Lennie begged, "Le's do it now. Le's get that place now."

(John Steinbeck, Of Mice and Men)

The advent of inexpensive desk top computing has resulted in increased demands by decision makers at the college and departmental levels for direct access of administrative data bases. They are setting with us looking across to the ideal distributed information system—just on the other side of the river. This interest of data processing end users in generating their own decision support materials has given rise to a set of data related concerns that fall under the rubric of data administration. As with most new functions, the data administration function has taken many forms. In general, its purpose is to manage the non-technical aspects of data base creation, maintenance and use. In part, the data administrator is responsible for facilitating the use of institutional data bases across the campus. The data administrator needs to build the bridge between the data base and the user. Presentations at CAUSE, AIR, SCUP and other associations have documented that institutions, in one form or another, are building the data administration function. These presentations have also discussed the problems of creating an environment conducive to the effective use of institutional data bases, campus-wide.

While the data administration function is evolving to help users access data, a series of data/information "use" related issues must be addressed to bridge the gap and to assist the user in effectively applying the information. These issues have not historically been the concern of the data processing center. Data quality and its use have been the responsibility of custodians of the data and/or the institutional research office.

Why is data quality now suddenly becoming such a critical issue? Has it not been a concern of those responsible for federal and state reports in the past? Who has assured both external and internal decision makers of the integrity of reports and other decision support activities based on institutional data? Historically, decision support (using institutional data bases) has been been limited by the state of the art of computer and communications technology. In general, administrators were dependent upon the "mystics" that were able to manipulate the data bases to create information. Institutional research (either a separate unit, or through the registrars office or the computing center) often provided the interface between the decision maker and the "mystics" Often, the institutional research office employed "mystics" of their own that could be dedicated to the development of information for decision making.

It was through these processes of working with data that those in the institutional research office learned about data peculiarities, data collection processes, and reporting time tables. All of these have an effect, often negative, on data reliability and validity. In their role as the interface between the data processing function and the decision maker/planner, institutional researchers developed the processes that insured data integrity in their reporting and decision support activities. However, these processes are not inherent in the collection of the data or its processing by the computer center. As such many operating data bases are created and maintained without concern for their use in decision making or planning activities.

In the past ten years, institutional administrators have increasingly demanded direct access to institutional data bases to support their own decision making and planning activities. Four "conditions" are generally responsible for this change. All four of the following occurred at the same approximate time:

1. Increased competition for fewer dollars.
2. Increased accountability both from a financial and spending concern as well as the latest demand for assessment of what students have learned and how the institution has shaped their academic and personal maturity.
3. Proliferation of cheap but powerful computing across the campus providing the technology that can make institutional data readily available to any one needing or wanting it.
4. A greater number of mid-level and senior managers with experience in using computers to help in solving problems.

Managers in today's institutions know the capabilities of the technology and possess the basic knowledge to use the computer. The result is a desire to manipulate the data themselves and not

depend on a central unit that does not know or possibly understand the uniqueness of their unit. The result has been a clamoring by virtually all units on campus to have direct access to institutional data bases stored on the mainframe. Institutional Research is less likely to be in a filtering or buffering role. Computer centers have tried to meet the demand by providing the access and creating Information Centers to help the users "de-mystify" the intricacies of their hardware and software.

Now the additional technical advances along with the promises of local area nets are going to make the distribution of data bases a reality for most institutions. We have dreamed of this day but there are some of us who think we hear voices and are not sure that the future automatically holds the promise that we can, in Steinbeck's words, "live on the fatta the lan'". We are not sure that we want someone to tell us about the rabbits one more time.

The basis for this skepticism comes from the state of the art in data administration. At present data administration seems to focus primarily on issues of security and the development of data dictionaries. Rarely does the data administrator take on the issues surrounding data integrity or use. Though data administration has been viewed as important, it seems to have taken second place to the exciting technical advances of computing and communications. We suggest that if data do not have integrity and usefulness, user frustration will lead to hostility. Attention to enhancing data quality increases the likelihood that "Ever'body gonna be nice to you, Ain't gonna be no more trouble" (Steinbeck).

The critical question concerns what will happen if data administrators ignore issues of data integrity. Can we assume that natural forces will bring order, value, and worth to a decentralized system? Our premise is that "Left on their own, things do not tend to spontaneously move to more and more ordered states...if things are left unattended they soon become more and more disorderly. Bringing things back into a state of order requires the expenditure of additional energy" (Rifkin and Howard, 1981:43).

As our information systems become more decentralized, they will tend to move from a state of order to disorder. Our challenge is to learn that knowledge which will simultaneously develop an information system's state of order while strengthening the ability to provide of information to our decision makers. When faced with this challenge, we need to find a means for developing a

comprehensive set of questions which we can ask ourselves. Through inspection of the answers, we can better prepare efforts to meet the challenges of "un-centralized" data administration.

This paper presents insights drawn from earlier work in the field of behavioral science research to develop a useful set of questions. Specifically, we draw on the work done by the APA on reliability and later work by Donald T. Campbell on internal, construct, and external validity. These concepts are selected since both the behavioral science researcher and the information professional are in the business of providing support for decision makers. Therefore, both must be concerned with similar data information issues. The intent of the following is to apply the concepts of reliability and validity from behavioral research to our use of computerized information. The purpose is to explore whether this process produces a useful set cf questions for dealing with data administration.

Reliability

Reliability is defined as the degree to which independent but comparable measures would obtain the same results (Churchill, 1979:64). The cause for unreliability comes from random error. For traditional estimation techniques, reliability is estimated in terms of 1) stability—two looks at a measure over time; 2) consistency—two similar looks at a measurement at one point of time with similar items; and 3) objectivity—two looks at a measurement with different evaluators (Wiersma, 1975).

The following is an adaptation of these three types of chance fluctuation to the use of a data base and to development of the questions we should raise to avoid the problems of unreliable data.

<u>Stability</u>. If the same data is viewed at two points in time will it have the same value? The most obvious procedure to improve the stability of data bases is to create point-in-time (census) data bases. Where this is not possible or not practical, one must make sure that all data values have a time-date stamp of creation. To insure the proper interpretation, the documentation must specify also the procedure used to capture the data. Assumptions need to be developed that this capture was at a point in time or fixed relative point in time (e.g., the fourth day of class). A final help in the stability of the data is to select items which are as stable as possible (average GPA rather than grades in math).

Objectivity. If the data is obtained by two different procedures, will it have the same values? The main challenge to objectivity comes from the capture of the data. Data capture problems arise when clear instructions to coders are lacking. For example, if non-central coders are using different code sheets, objectivity is lost. In a non-central system, it is also important to reduce the number of times a data element will appear. If there are two locations for an item such as high school which a student attended, the data can, and on occasion will, differ.

Two types of problems can also occur with respect to user error. First, the users fail to understand the variables—when is pay equal to total pay, institutional pay, or general pay. The second type of problem arises in the selection of the sample of interest—when is faculty comprised of those who are full time instructional versus those who are not classified and receive pay for their activity. These dangers are increased in a decentralized system where there is a possible lack of continuity or even communication between the custodian and the user.

Preventing such problems will depend on documentation to prevent confusions in interpretation. Introduction of an official flag on important variables such as pay or groups such as faculty is one procedure for dealing with the problem. Such a derivation needs to be documented and its use enforced by the organization.

There is a counter caution, not all variables with the same name will be identical in definition. Therefore, cleaning up a non-central data base needs to be done with care.

Internal Consistency. Are pair-wise combinations of codes occurring which are not possible within variable definition? The lack of internal consistency comes from several main sources. One of the more common problems is the failure to use a consistent, mutually exclusive set of codes for variables. Another problem comes in the improper capture of data. Front-end audit programs can help with both of these problems. Unfortunately, front-end audit programs often require that several non-central data bases communicate. This is often not possible due to failure of organizations to develop information systems with such a capability. Another option is to put edit checks into place with batch jobs which merge and perform internal audit checks. Once an inconsistency is found, there needs to be an enforced procedure of determining the correct category and making the modification to one or more data bases.

Internal consistency also requires a need for a standard set of codes for each element which can occur in more than one place. College code can occur from the FICE code, the ETS code,

or a local set of codes. Failure to standardize such codes places heavy dependence on lookup tables and greatly complicates efforts to maintain an internally consistent data base.

Lack in consistency in coding and impossible combinations can be prevented, or at least reduced. Data administration must take an active role while armed with a good data dictionary. It is also essential that common keys be used across data bases of like entities so that relationships can be made for pair-wise comparisons rather than requiring the chaining of data bases.

Validity

Validity is defined as the degree to which something does what it is intended to do (Carmines and Zeller, 1979). The validity of information in data administration is concerned with measuring, or providing information, which can be understood and used. What do the data mean? How can they be used? The lack of validity comes from the presence of systematic bias in the information. Validity can also be limited by the reliability of the information. In other words, unreliable information can not be valid.

Traditional work in the research validity has focused on the internal, external, and construct validity of the information coming from the research. This section of the paper will address separately issues falling under each category.

Internal Validity

Internal validity relates to the ability to draw proper conclusions from a research project, or (for our purposes) a data base. At this level, validity answers questions of "What does this information mean?", "How should we interpret the information?" To address these questions, we will examine the 12 types of threats identified by Babbie in The Practice of Social Research (Babbie, 1986). They are grouped into three categories--internal validity of variables, internal validity of procedures, and internal validity of support.

Internal Validity of Variables

1. History: Has the definition of the variables changed over time? Example -- In 1986-1987 room utilization was measured on the first week of class, in 1988 it was measured on the

second week. A complication is that historical occurrences are not likely to be known across decentralized units of an organization.

2. Maturation: Does the definition of this element change at some bench mark? For example, the quarter first enrolled is actually the quarter applied for admission in either undergraduate or graduate and is "updated" when the undergraduate applies to graduate school. Characteristics of other measured elements change over time, for example the number of students will increase up to the last day to add courses and then it will decline.

3. Instrumentation: Is the definition consistent for the entire data base? For example, salary is defined as equivalent pay for those on leave with part pay but is total for those on leave with no pay.

Internal Validity of Procedures

4. Data collection in sequence of events: Do all those who collect this variable collect it at the same point in the sequence of events? For example, one department may post appointment forms before computing number of employees, another department may post after the computation.

5. Selection Bias: Are the same criteria used to include individual observations in the data base? For example, one college includes students who have enrolled for credit courses as students, another college includes those who pay fees.

6. Experimental Mortality: Are identical rules used to determine how long to keep non-active elements on the data bases? Standardized rules for archiving need to be established.

7. Timeliness: Are elements updated before merges? Are "Hours taken this term" part of "Total hours"?

8. Diffusion: When changes are made in and element or an event is captured, does the update go to all occurrences of the appropriate data elements? For example, when a faculty is

removed from the payroll in personnel, does this information get posted to the down-loaded data bases kept by the Dean?

Internal Validity of Support

9. Extremism: Do individuals in various parts of the data/information system work to support each others' needs? Problems easily can occur when one group is asked to collect and keep data elements which are central to another groups success. These extreme or boundary elements typically are not going to receive the same level of support as elements central to the custodian's purpose.

10. Compensation: Are the various elements of the decentralized system receiving their "fair share" of resources to perform their responsibilities to the same standard. Have you been boxed into a conceptual corner where extra resources go to those who do a poor job?

11. Compensating Rivalry: Are all of those who work in the information and data processing system working to support each other? Is there executive competition which is reflected in the operations of decentralized information/data processing units?

12. Demoralization: Have parts of the decentralized data system been bashed until they "Just don't give a damn" any more?

External Validity

External validity of a data base involves the degree to which information from a data base can be used, or generalized, to decisions which need to be made or questions which need to be answered. This is the worth of the data and information. Are application benefits produced in a relevant and sufficient manner? While "threats" to external validity are less definite than internal validity, there are three characteristics which must be designed into a non-centralized data base to insure that the information system has worth—accessibility, comprehensiveness, and relevance.

1. Accessibility: Are the data accessible at a level of complexity consistent with user capabilities? If users cannot get to the data they are worthless. As one goes to a non-centralized system,

the likelihood of different softwares, different DBMS, and different machines greatly complicate the accessibility of data. A compounding problem is the data custodian who is over-active in developing security systems.

2. Comprehensiveness: Does the information provide the decision-maker/user with sufficient insight to understand what is occurring, will occur, or has occurred. Can the information address the major components of a problem solving situation? Information systems have worth in monitoring systems and providing input for solving problems. Some of these demands can be predetermined by some front-end information needs analysis. Other needs are much less predictable. The critical element for comprehensiveness is to have a good feel for the relevant decision space of the organization. A particular problem in the non-central system is to balance comprehensiveness while avoiding unmanaged redundancy.

3. Relevance: Does the information focus on the factors which are critical to the success of the users? Within any institution there are going to be specific key problems. At an urban institution the key problem may be anticipating new enrolling students. At a comprehensive research institution the problem may be flexible space. At a two-year school, the problem may be enrollment marketing. The only way to insure that an information system achieves relevance is to get input from key decision makers. Some help can also come from increasing awareness of the types of decisions being made at comparable institutions.

Construct Validity

Construct validity is defined as the degree to which a measure assesses the construct it is purported to measure. The measure must "be useful for making observable predictions derived from theoretical propositions" (Peter, 1981).

A primary threat to construct validity is the use of single items to measure a given concept. Still a data base cannot be expected to contain all possible items or measures and still be cost effective. After identification of the main functional areas in which judgments must be made, the need to be cost efficient while avoiding use of single measures suggests that a minimum of two or three indicators be developed for each construct. This is particularly appropriate where the data base is designed for executives and is comprised of summated or derived elements.

Recommendations

The following recommendations are based on the preceding discussion of internal, external, and construct validity.

1. Develop, use, and enforce a comprehensive data dictionary. This will go a very long way to establishing a data base with adequate reliability. The data dictionary should be done at a central level (Ross, 1981).

2. Develop standard procedures for doing data administration. Have an organization in charge of making these policies into practice, insure it has top level support. Get top level support with vision, resources, and enthusiasm. This support should include a quality control function somewhere in the organization. This will develop the internal validity (Durell, 1985).

3. Insure the interaction of various users and custodians of data with coordination of those involved in the management information and analysis function (sometimes known as Institutional Research). This integration of the key individuals involved in the collection, creation, and use of information should also drive both a formal and informal training program. This will insure training around sound concepts. Also it will meet many of the challenges of external validity.

4. Think logically and strategically about information. Become an an entrepreneur with a product to sell. Get to know your customer (the controller making computations from data, the manager making decisions from information, and the executive making judgments with intelligence). Know your product. It takes effort to move facts into more usable forms of data, information, and intelligence. Know your profession. Your professional level of knowledge, skills and abilities, and a little help from a friendly network of colleagues, will give the maturity of judgment required to provide support in day-to-day operations while putting together the support required when sudden "challenges and opportunities" arise. This approach to information will help ensure the construct validity of decentralized data operations by providing a conceptual framework, plan, or map of activities (McLaughlin, McLaughlin, and Howard, 1987).

Summary

The use of concepts such as reliability and validity to determine the usefulness of research has raised some questions about what is important if we are to perform as professionals in a decentralized information environment—an environment which appears inevitable. These concepts have emphasized the need for a active data element dictionary coupled with a competent and pervasive data administration function. The concepts also emphasize the need for developing a capable user community which shares the value of data as an institutional resource. The final prompt from this exercise is to emphasize that those working with facts in their various forms need to look to their professional competency to take an active role in determining the future use of their professional skills.

What if we fail to take the necessary steps to insure the integrity and usefulness of our data bases? If we fail to turn our attention to the problems at hand, it is unlikely that information for control and strategies decisions will improve in quality or impact. "Printing out of numbers at the computer center will, nevertheless, continue to increase in volume" (Jones, 1982). If, however, one accepts the concepts of Entropy, then the alternative is evident:

> "Strangely enough, it seems that the more information that is made available to us, the less well informed we become. Decisions become harder to make....As more and more information is beamed at us, less and less can be absorbed, retained, and exploited. The rest accumulates as dissipated energy or waste....The sharp rise in mental illness in this country has paralleled the information revolution. (p170)"

There were crashing footsteps in the brush now. George turned and looked toward them. "Go on, George. When we gonna do it?"
"Gonna do it soon."
"Me an' you."

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REMOTE OPERATION OF A MICRO SOFTWARE PACKAGE THROUGH A MAINFRAME COMMUNICATIONS NETWORK

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ABSTRACT

The three segments of higher education in California recently cooperated in the development and field testing of a micro-based package called ASSIST. It takes the graduation requirements of any four-year institution, the articulation agreements between any community college and that institution, and a community college student's transcript and calculates what courses the student has yet to take at both the community college and the four-year institution to graduate. It best runs on an 80386 machine with 300 MByte hard disk capacity. Los Rios has used "ASYNC PASSTHROUGH" on its CDC network to allow counselors at three colleges to use the micros in their offices to access/run ASSIST located on other micros attached to the network.

BACKGROUND:

The Los Rios Community College District, located in Sacramento, California, has 45,000 students currently enrolled at one of our three colleges, an education center, and a number of outreach centers. Administrative and clerical staff are found at these locations and at the District Office.

Computer equipment to support administrative and clerical staff takes three forms:

1. A ten-year old Honeywell mainframe computer located at the District. Office. Approximately 80 terminals located at various district sites are connected to the computer through telephone lines. The Admissions and Records, Instructional Administration, Personnel, and Business Departments use this system heavily.

2. Two small Control Data Corporation (CDC) mainframe computers (Model 932/32) located at the District Office. Approximately 90 terminals at various district sites are connected through telephone lines. These computers were bought to replace the Honeywell computer, and conversion of the Honeywell programs to the CDC is currently underway. The first service provided on this new system was terminal access to transcript data (heretofore available only in printed form) and the remote printing of transcripts. These services were extended beyond Admissions and Records Departments to include the 42 full-time counselors in the District. We accomplished this by placing a terminal in each counselor's office and a laser printer (or two) in each Counseling Department.

3. Approximately 110 microcomputers located in various administrative and clerical offices. All these microcomputers are connected to the two CDC mainframes through the same communications network that is used by the 90 CDC terminals. Most of the microcomputers are used for local word processing (WordPerfect) and Electronic Mail.

Figure 1 shows the number of terminals and microcomputers at each of the major sites.

During the last two to three years while we were acquiring the CDC and initiating the conversion, Los Rios also participated in a statewide Pilot Project of a computer program called ASSIST. In this pilot, the eight University of California campuses, five of the nineteen State Universities, and seven of the California Community Colleges experimented with use of a microcomputer-based computer program developed by the University of California at Irvine in conjunction with Los Angeles Harbor Community College.

The computer program has many features, but one for which it is best known (and most highly valued) is the "progress check" performed for a community college student with plans to transfer to a four-year institution. This portion of the program combines the student's community college transcript, the graduation requirements of the major that the student wishes to complete at the four-year school, and a previously stored data base of articulation agreements (which describe course transferability) to create for that student a list

of courses that must yet be taken at both community college and the four-year institution. The computer program requires only one to three minutes to generate this list as opposed to the one to two hours that a student and a counselor usually must struggle with catalogs, transcript, and binders of articulation agreements.

After participating in this statewide Pilot for three years, Los Rios decided to institutionalize ASSIST throughout the District. In the preferred scenario, we would have provided an ASSIST microcomputer and program to each of the 42 counselors. However, the unit cost of $9,000 was prohibitive. An interim solution was implemented, in which we placed three ASSIST micros at each college's counseling center in open and shared environments. The awkwardness of this arrangement are many and obvious. Happily a solution recently presented itself in the form of a new CDC communications network product called "ASYNC PASSTHROUGH."

THE PRESENT:

When we were first told about ASYNC PASSTHROUGH it was described as a computer program that would make it possible to "connect" any two micros on the CDC communications network (called CDCNET) and exchange data between them. This function held out the possibility that, if we replaced each counselor's terminal with a minimally configured microcomputer (approximately $900 each) counselor could access the ASSIST program located in the shared environments from the convenience of their own offices. We bought the product on a trial basis.

With existing microcomputers used by members of the Computer Services Department who are Microcomputer Specialists, we attempted to implement the ASYNC PASSTHROUGH program. We discovered, as one often does in this kind of project, that there was a little bit more involved than we initially expected. Basically, we had to acquire and use two additional micro-based programs, "CONNECT" and "CLOSE-UP." CONNECT facilitates the communication of micros using CDCNET, while CLOSE-UP makes it possible for an individual using one micro on a network to operate any other micro once the two are connected.

When these two programs are installed on an ASSIST microcomputer attached to CDCNET, the following activities occur each time the ASSIST microcomputer is turned on:

1. CONNECT establishes an Async Passthrough connection to CDCNET;

2. CLOSE-UP puts the microcomputer in a mode to be remotely operated;

3. The ASSISTS computer program is initiated and brought to the point where the title screen is displayed, and;

4. The microcomputer waits until a counselor micro seeks a connection.

When these two programs are installed on a counselor's microcomputer, the following activities occur each time the microcomputer is turned on:

1. A "menu" of choices is displayed, one of which is to connect to ASSIST.

2. When this option is chosen, CONNECT works with CDCNET to establish a connection to the nearest inactive ASSIST microcomputer.

3. The version of CLOSE-UP on the counselor's microcomputer works through this connection to establish a link with the version of CLOSE-UP on the ASSIST microcomputer that gives the counselor remote control of that micro.

4. The ASSIST title screen appears on the monitor screen of the counselor's microcomputer, and the counselor begins to use ASSIST as though it were on his/her own microcomputer.

5. When the counselor is finished using ASSIST, the two keys "ALT" and "E" simultaneously and the connection to the ASSIST microcomputer is broken. The ASSIST microcomputer returns to its inactive state and the counselor's microcomputer is available for other options specified on the menu (electric mail, access to student data, word processing, etc.).

Figure 2 illustrates the communication network components employed in establishing the connection between a counselor's microcomputer and an ASSIST microcomputer. When a counselor exercises the menu option to connect with an ASSIST microcomputer, the request passes from the counselor's microcomputer (A) through a T.D.I., to an R.T.I., to a modem, across the telephone line to a modem at the District Office, to an N.D.I., and finally to one of the 932/32 mainframe computers. In that computer is stored a list of ASSIST microcomputers and their locations. The CDC mainframe chooses the ASSIST microcomputers (**B**) closest to the counselor's microcomputer and attempts to connect to it. If microcomputer **B** is inactive, the connection is made and the counselor begins to use ASSIST. At that point the CDC mainframe is no longer required to support the communication between the two microcomputers. For in creating the connection between the two microcomputers, it established a temporary L.A.N. (Local Area Network) in which the two microcomputers communicate through the T.D.I. that they share. No part of the communication needs pass through the college's R.T.I., the modem, the telephone line, or any equipment located at the District Office.

If microcomputer **B** is active (being used by another counselor), the CDC mainframe will choose the next nearest ASSIST microcomputer (**C**). Once the connection is made, the college's modem, telephone line, and the District Office equipment are no longer required and are redirected to other activities. Again a temporary L.A.N. has been established at the lowest level possible.

If all the ASSIST microcomputers at the counselor's college are busy, than the CDC mainframe will attempt a connection to an ASSIST microcomputer located at one of the other colleges (**D**). If microcomputer **D** is inactive, than a connection is established from microcomputer **A** through to the T.D.I., to the R.T.I., to the college modem, across the telephone line, to the District Office modem, to the N.D.I. serving the counselor's college, to the N.D.I. serving the other college, to its modem, across the telephone line, to the R.T.I., and

(finally!) to microcomputer D. Once this connection is established, the CDC mainframe is no longer involved. A temporary W.A.N. (wide area network) has 'een established at the lowest possible level.

All of this connection selection activity is invisible to the counselor. The counselor merely selects the ASSIST option (from the menu of choices that appears on the screen when the counselor turns his/her microcomputer on) and waits until the ASSIST title screen appears on his/her microcomputer. The counselor has no idea which ASSIST micro he/she is using, much less where it is located.

FUTURE:

Having established the viability of the Async Passthrough, CONNECT, and CLOSE-UP using the microcomputer specialists, we have now replaced the terminals with microcomputers in fifteen counselors offices (five at each college). Our initial experience with the fifteen has uncovered no new problems. The system is working fine. We are now in the process of incrementally replacing the rest of the counselors' terminals with microcomputers.

Our success in accessing ASSIST through CDCNET and ASYNC-PASSTHROUGH has encouraged us to examine the possibility of accessing other microcomputer- based computer programs/services. Those currently under consideration include:

1. CAPPS - An assessment support system
2. EUREKA - A career advising program.
3. Any one of a number of microcomputer controlled optical disk systems.
4. A financial aids analysis system.

With every innovation or change, there are accompanying problems. No solution is problem free. The great challenge in implementing any change is to ensure that this new set of problems is less painful for the individuals and the organization than the set of problems that the innovation or change was meant to solve. Our brief exposure to ASYNC-PASSTHROUGH leads us to conclude that it is that type of innovation.

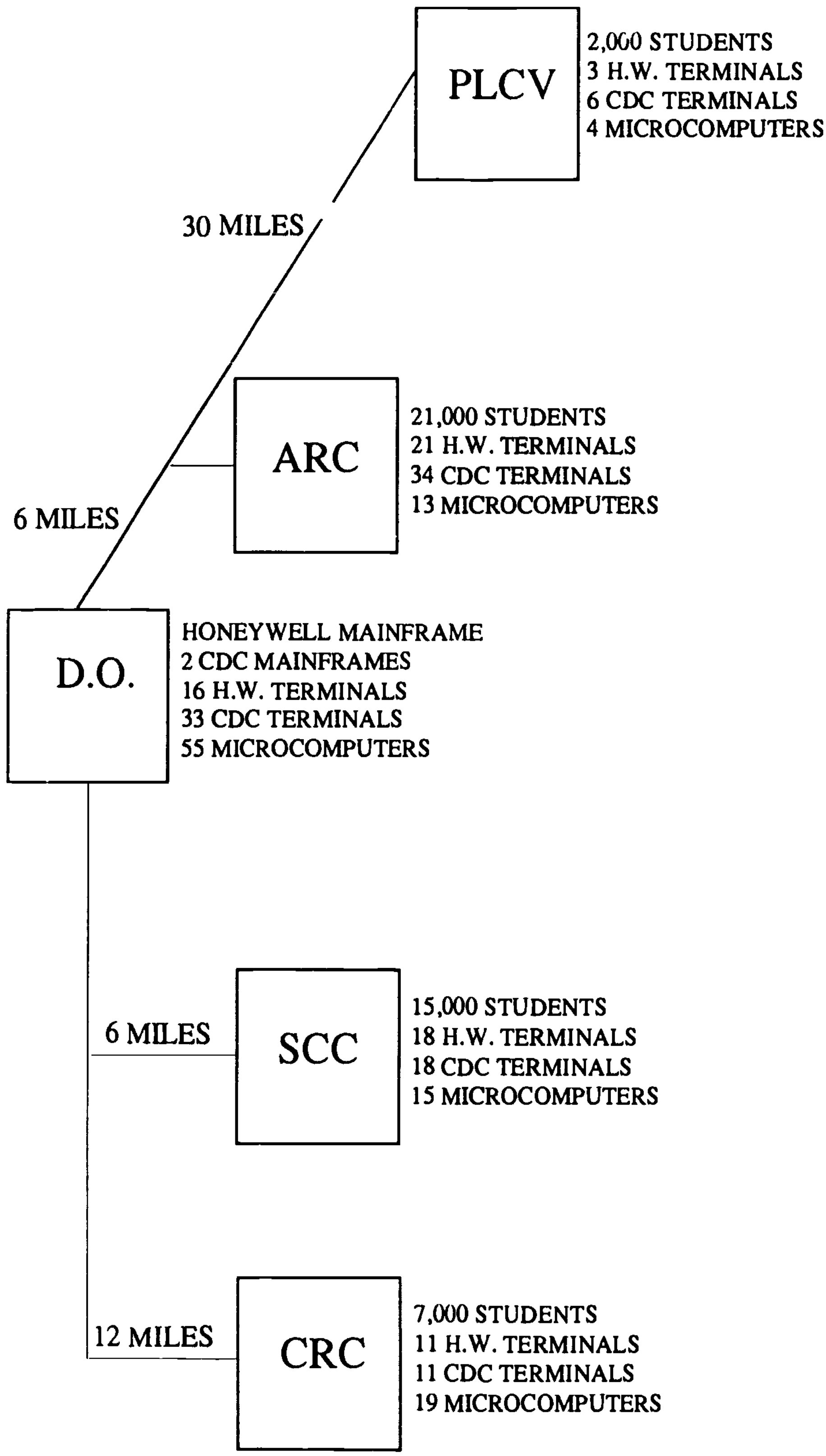
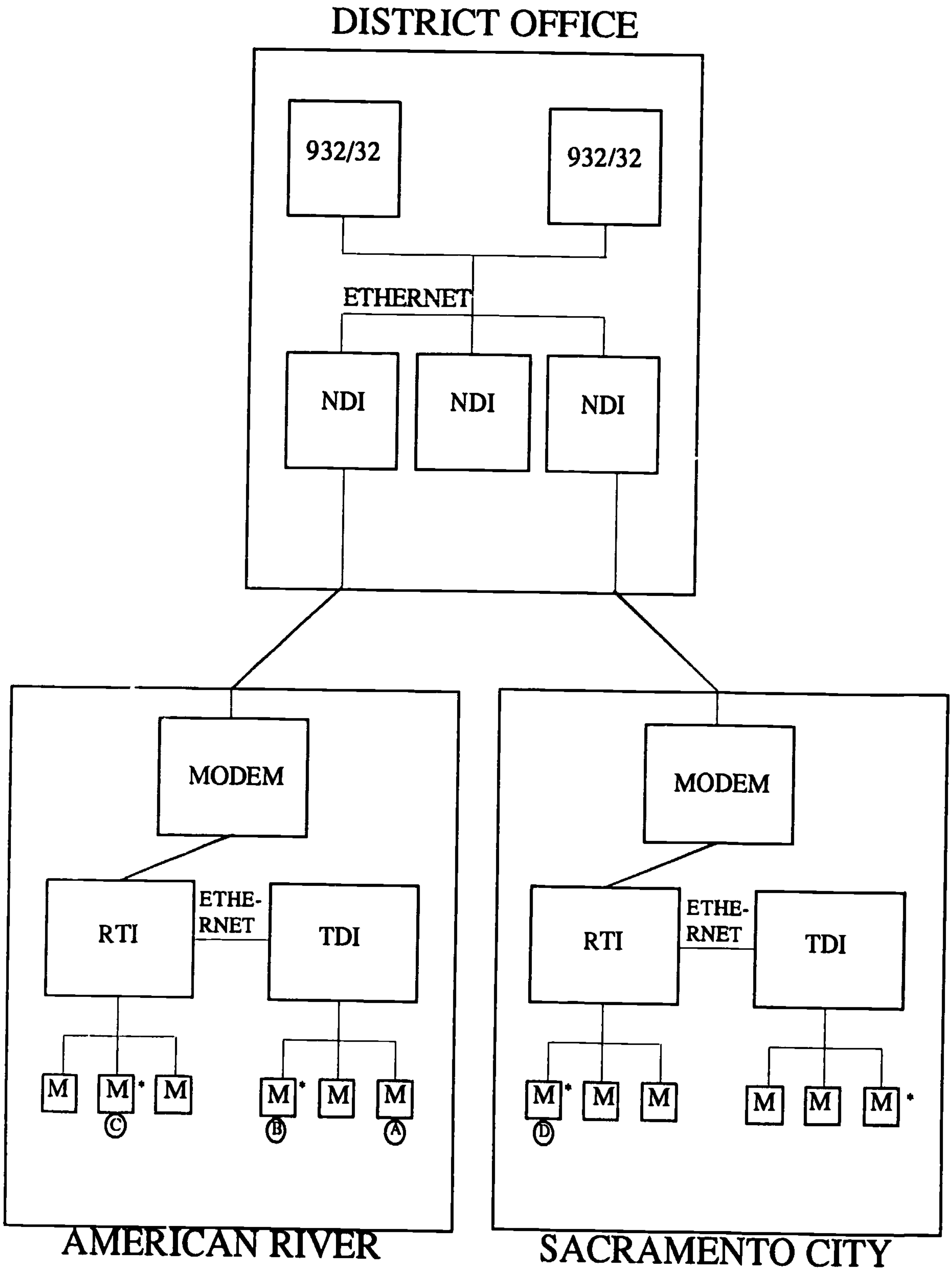

PLCV
2,000 STUDENTS
3 H.W. TERMINALS
6 CDC TERMINALS
4 MICROCOMPUTERS
30 MILES
ARC
21,000 STUDENTS
21 H.W. TERMINALS
34 CDC TERMINALS
13 MICROCOMPUTERS
6 MILES
D.O.
HONEYWELL MAINFRAME
2 CDC MAINFRAMES
16 H.W. TERMINALS
33 CDC TERMINALS
55 MICROCOMPUTERS
6 MILES
SCC
15,000 STUDENTS
18 H.W. TERMINALS
18 CDC TERMINALS
15 MICROCOMPUTERS
12 MILES
CRC
7,000 STUDENTS
11 H.W. TERMINALS
11 CDC TERMINALS
19 MICROCOMPUTERS

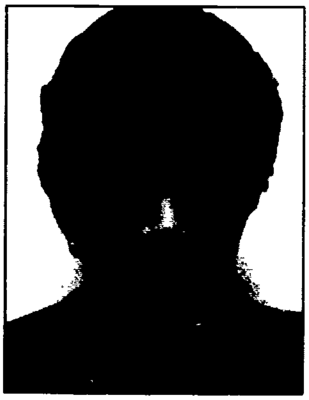
FIGURE 1



* ASSIST MICROCOMPUTERS

FIGURE 2

Track VI
Outstanding Applications



Coordinator:
Milly Koss
Harvard University

Several outstanding applications have resulted from successful integration of information technologies. Papers about these applications show what some institutions are doing in the development, implementation, and operation of information resources.

Barbara A. Lockett,
Rensselaer Polytechnic University

Daniel V. Goulet,
University of Wisconsin / Stevens Point

Steve R. Watson,
Washington State University

Designing DB2 Data Bases Using Entity-Relationship Modeling A Case Study - The LSU System Worker's Compensation Project

Cynthia M. Hadden and Sara G. Zimmerman
Louisiana State University
Baton Rouge
Louisiana

The Entity-Relationship approach to data base design, a state-of-the-art design methodology, has become the accepted design methodology at LSU. Using this design methodology, new systems are being implemented much faster with less conflict between Data Base Administration, Development Analysts, and Users. The LSU Worker's Compensation data base was one of two pilot data bases designed using Entity-Relationship Modeling techniques and implemented in DB2. An account of this project, the design methodology, and considerations which should be given when implementing the design in DB2 are presented.

Designing DB2 Data Bases Using Enitity-Relationship Modeling: A Case Study - The LSU System Worker's Compensation Project

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The LSU System Worker's compensation project was one of two pilot projects at LSU which were designed using Entity Relationship modeling and implemented in DB2. The Entity-Relationship approach to data base design which was used in the Worker's Compensation project has become the accepted data base design methodology at LSU. This methodology has eliminated the confusion previously associated with data base design and has led to a reduction in application development time.

The LSU System Worker's Compensation project was chosen as a DB2 pilot project for two major reasons. The Worker's Compensation system is small and has a small number of users. Also, there were no high pressure demands or deadlines put on the project because there was an existing PC system in place.

This paper is an account of this pilot project, the design methodology used and the considerations which were given or should be given to DB2 data bases. Part I contains overviews of data base design at LSU, the LSU DB2 environment and the Worker's Compensation pilot project which is the subject of the case study. In Part II, data base design using Entity-Relationship modeling is examined.

I. BACKGROUND

Data Base Design History

Several years prior to the Worker's Compensation project, standards for application development at LSU were established. These application standards included five phases of development: requirements definition, external design, internal design, program development, and system implementation. These development standards had been proven to be successful. However, at the time the Worker's Compensation project was initiated, there were still no guidelines for data base design. Data base design was done almost as an afterthought between the external and internal design phases of the project. Also, due to a major reorganization of the computer center and rather high turnover, the data base administration team was relatively new and inexperienced; the senior analyst on the team had about three years experience in the data base area. Needless to say, data base design was a source of much confusion and friction.

Prior to the Worker's Compensation project, the initial data base structure was often proposed by the project leader. The project leader would have most likely arrived at the proposed data base by grouping elements into segments and segments into data bases. In other words, the project leader would have used a "bottom up" approach. Typically, segments and data bases were grouped not by any relationships between the data but by how the data was to be displayed on screens identified in the external design phase of the project. A data base designed this way would often last only as long as the end-user's business processes remained the same.

The proposed data base structure was submitted to data base administration. The DBA analyst, knowing little or nothing about the project, would review the data base design. The review often resulted in the DBA analyst unnecessarily investigating every data element proposed in the new data base. The DBA analyst would make recommendations on indexes, logical relationships, etc... Sometimes, however, the analysis of the data would lead the DBA analyst to propose a new data base design; the new design was often based on the instinct of the DBA analyst.

The result, of course, was conflict between the DBA analyst and the project leader. This usually painful conflict prolonged the application development time. A rift began to develop between the data base administration and application development groups.

In the fall of 1985, two DBA analysts attended an IBM class entitled Data Base Administration and Design. In this class, the Entity-Relationship approach to data base design was introduced. As it turned out, Dr. Peter Chen, a professor at LSU, had proposed the methodology. Although at that time there was no contact with Professor Chen, a copy of his monograph "The Entity-Relationship Approach to Logical Data Base Design" became a valuable tool in data base design at LSU. The Worker's Compensation data base presented here was one of the first data bases designed at LSU using the Entity-Relationship (E-R) approach. The E-R approach works hand in hand with the application standards already in existence. The friction between project leaders and DBA analysts has been eliminated and application development time has been reduced. Since Worker's Compensation, all new data bases at LSU have been designed using this approach.

Database 2

Although Release 1 of DB2 was installed at LSU in December, 1985, it was not really available until mid-to-late sumer 1986. Even at the time it became available, everything was not in place for application development. Some of the problems were DB2 related; some were due to the inexperience of the DB2 system programmers; and others were caused by general constraints on a heavily used CPU.

One of the earliest problems was Common Service Area (CSA) constraint. CSA limitations were so severe that the test IMS system could not be brought up during regular work hours. DB2 required, however, that application programs be tested under a test IMS system. Unfortunately, the time constraints on the two DB2/IMS pilot projects required that coding and testing be done before the situation could be corrected. This meant that DB2/IMS applications had to be tested early mornings, nights and weekends.

Things improved over time, however. New releases of other IBM products that provided CSA constraint relief were installed. In the fall of 1986, only one application program could be tested at one time. At Christmas, DB2 Release 2 was installed and test IMS was being brought up all day. Just about the time the Worker's Compensation System was transferred to production in the spring of 1987, there were full test and production DB2 environments. At the time of this writing, there are fifteen data bases in production and eleven new data bases in development. An additional DB2 system has been implemented in an ISPF/QMF environment.

System Worker's Compensation Project

The LSU System Worker's Compensation (SWC) office handles documents related to injuries and illnesses that occur while an individual is employed on an LSU campus. The SWC office handles approximately 2000 new injuries per year along with many associated forms and documents. This office is responsible for injuries that occur on ten campuses, located state-wide, and approximately four outside agencies, the most important being the State Office of Worker's Compensation and the independent insurance company which handles the worker's compensation claims. An injury report, which is filled out by the campus personnel office, initiates the involvement of the SWC office. From this point on, all forms and inquires generated as a result of that injury will relate to the injury report.

There were numerous requirements for the new system. The primary system objectives were to:

- provide an easier, more efficient manner of gathering all data associated with an injury report;
- provide a distributed method for capturing the data from the campuses and then departments within the campuses;

- provide a centralized location of all data to improve reporting capabilities;
- allow for multiple injuries per employee and associate incoming documents with the correct injury;
- track medical bills, payments, checks and settlements;
- insure that the injuries were reported to the State Office of Worker's Compensation within the legally defined number of days to prevent fines set at $100.00 per late notice.

II. ENTITY RELATIONSHIP MODELING

The Entity-Relationship (E-R) approach to data base design is a three phase process in which a model of a business in translated into a physical data base mapping. The three models which are used include:

1. Entity-Relationship Model
2. Conceptual Data Model
3. Physical Data Base Model

The Entity-Relationship Model (ERM) is a model of a business. The Entity-Relationship Model is a model of what a business is about and not how the business carries out its operations. The ERM is the cornerstone of the whole Entity-Relationship modeling process. The Conceptual Data Model (CDM) is a plan for storing the data of a business based on the model of the business. Finally, the Physical Data Base model is a mapping of how the data will be stored in a particular data base management system such as IMS or DB2. It is important to note that the physical data base management system is not even discussed until the development of the physical data base model. In the remainder of this text, each of these models will be discussed in more detail and the evolution of the Worker's Compensation data base will be described.

The Entity-Relationship Model

The Entity-Relationship Model (ERM) is a model of the business itself. This model is developed in two steps. The first step is to define the business entities; the second step is to identify the relationship between those entities.

The first step in defining the ERM is to identify the business entities. A business entity is a person, thing, or concept which has significant lasting value to the business. Examples of the business entities of a university would include students, courses, and employees. All three of these entities are crucial to the running of a university. Eliminating any one of these entities would change the nature of the business; it would no longer be a university. If the student entity were left out, for example, the business would no longer be a university.

Case Study

Six business entities were identified in the Worker's Compensation system:

a. Injured - the person who had the injury.
b. Injury Report - the Worker's Compensation record of an accident.
c. Insurer - the insurance agency currently handling all claims.
d. Claim - the claim filed with the insurance company.
e. Bill - bills incurred by the injured because of the accident.
f. Draft - checks issued by the insurance company for payment of medical bills, worker's compensation, and settlements.

Note that business entities are identified and not data about the business entities In defining Injured as a business entity, the focus is on the fact that an injured person exists and not on the information about a person.

Once the business entities have been identified, the relationships between the entities are defined. The nature of the relationships is also identified; that is, whether or not the relationship is one-to-one, one-to-many, or many-to-many.

Case Study

In the Worker's compensation system, eight relationships between the six different business entities were identified. The order in which the relationships are presented has no significance.

1. The Worker's Compensation office contracts with an Insurance Agency to handle Worker's Compensation Claims.
(One INSURER handles many CLAIMS.)
2. An injured person files an injury report with the SWC office.
(One INJURED may file many INJURY REPORTS.)
3. The injury report is filed as a claim with the insurance agency.
(One INJURY REPORT is assigned one CLAIM.)
4. &5. The injured person may incur bills as a result of a specific injury. The bills may be incurred before a claim has been filed with the insurance agency or after the claim is filed.
(One INJURY REPORT incurs many BILLS.)
(One CLAIM incurs many BILLS).
6. Drafts may be made on bills incurred as a result of the injury.
(Many DRAFTS pay many bills.)
7. Drafts may be made as a result of compensation and settlements.
(Many DRAFTS pay compensation for one CLAIM.)
8. The injured person may receive the drafts.
(Many DRAFTS are paid to one INJURED.)

According to the IBM Data Base Design and Administration class and Dr. Chen's monograph, entities are shown diagrammatically in boxes and the relationships between entities are shown in diamonds.

Case Study

The SWC Entity-Relationship Model is shown in Figure 1.

The Entity-Relationship model, independent of its use in data base design, is a very valuable tool. It is a succinct representation of the business being modeled. As such it is a great communication tool for discussion about that business, facilitating understanding between system design personnel and the personnel who will ultimately use the system.

The Conceptual Data Model

Once the ERM is identified, logical data base design, is attempted. The model used is the Conceptual Data Model. The Conceptual Data Model is a strategy for storing the data of a business based on the model of the business (ERM). The Conceptual Data Model addresses issues concerning where particular pieces of data will be stored. For instance, in the example relating to university entities, will grades be stored with information about the student or information about the class?

In the Entity-Relationship Model, emphasis was placed on the business entity itself; in the Conceptual Data Model, the focus is on the data associated with the entity. As stated earlier, student is a business entity for a university. In the Conceptual Data Model, the student data entity would contain the student's name, address, age, etc... It is important to note however that physical implementation of the data base (that is, whether the data bases involved will be DB2 or IMS) is still not discussed.

SYSTEM WORKER'S COMPENSATION ENTITY RELATIONSHIP MODEL

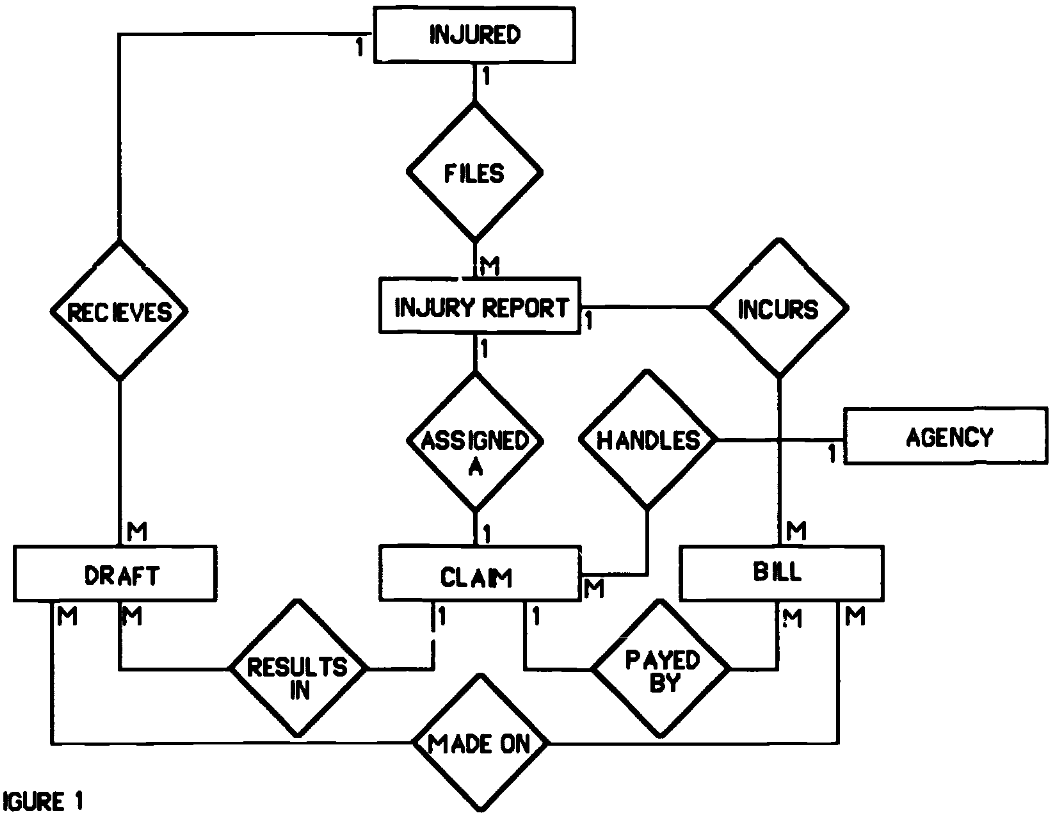
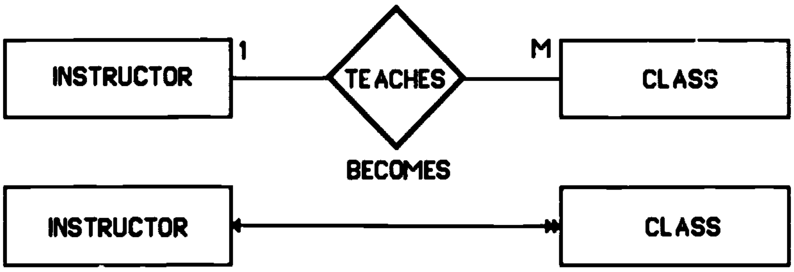


FIGURE 1

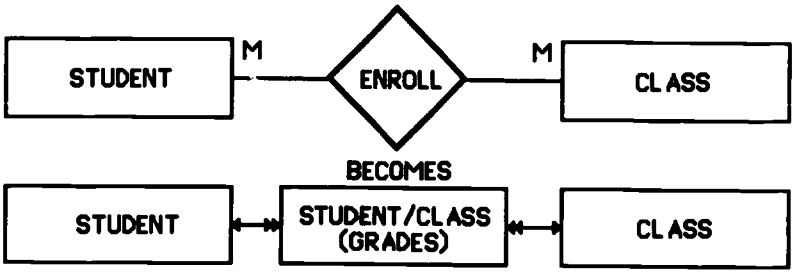
The Entity-Relationship Model is converted to a Conceptual Data Model (CDM) using very simple rules:

1. All business entities become data entities (kernels).
   Kernels are those data entities which capture information on the business entities identified in the ERM. In our university example, the student data entity captures information about the student business entity.
2. All one-to-one and one-to-many relationships remain intact.
   However, the diamonds are replaced with single lines having arrows at both ends. A double-headed arrow indicates the "many" side of the relationship; a single-headed arrow indicates the "one" side.



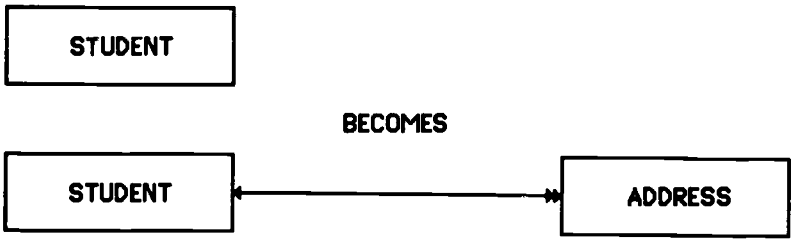
3. Each many-to-many relationship is converted into two one-to-many relationships and the intersection information becomes a data entity (associations).

   Associations are those data entities which capture information about relationships between business entities. Association entities are generally only needed when the relationships between business entities are of the many-to-many variety. Again, referring to the university example, association entities address questions such as where grades will be stored.



4. Repeating data is pulled out to form additional data entities (characteristics).

   Characteristics are information on a business entity captured repeatedly (repeating groups). In a university setting, if several different addresses are going to be stored for each student (home address, campus address, mailing address, etc...), then student address becomes a data entity.



Case Study

In the Worker's Compensation system, six kernels, one association and two characteristics were identified.

a. Injured (Kernel) - specific static information on the employee who was injured.

b. Injury (Kernel) - information related to the injury itself along with certain information about the injured at the time of the accident. This information was needed to report to the insurance company since these factors might figure in, in case of a law suit.

c. Claim (Kernel) - injury report information as sent to the insurance company. The claim and the injury report go hand-in-hand with one exception; the claim has a unique number assigned by the insurance company associated with it. This number, known as the file number, is not available at the time the injury report is entered into the system; it becomes available at some later date after the insurance company has received the injury report and issued a number for it. Once the file number is known, all correspondence between the insurance company and the SWC office relate to this number.

d. Bill (Kernel) - data on bills incurred by the injured as a result of an accident. Keep in mind an employee can have concurrent medical treatment for two separate injuries and the bills must be assigned to the right injury report. Also, bills may be received before the insurance company issues a file number.
e. Draft (Kernel) - data on the check issued by the insurance company for payment of medical bills, worker's compensation, lump sum settlements, etc.. If it is payment on a bill, it must be associated with that bill. A draft can also be payment on more than one bill.
f. Agency (Kernel - address data for agencies the system corresponds with in relation to an injury.
g. Bill/Draft (Association) - data about bills paid by drafts and how much of each bill was paid.
h. Claim Status Changes (Characteristic) - data on the status of a worker's compensation claim at different phases in the processing of a claim.
i. Lost Time (Characteristic) - a record on work hours lost due to an injury.

The SWC Conceptual Data Model is shown in Figure 2.

SYSTEM WORKER'S COMPENSATION CONCEPTUAL DATA MODEL

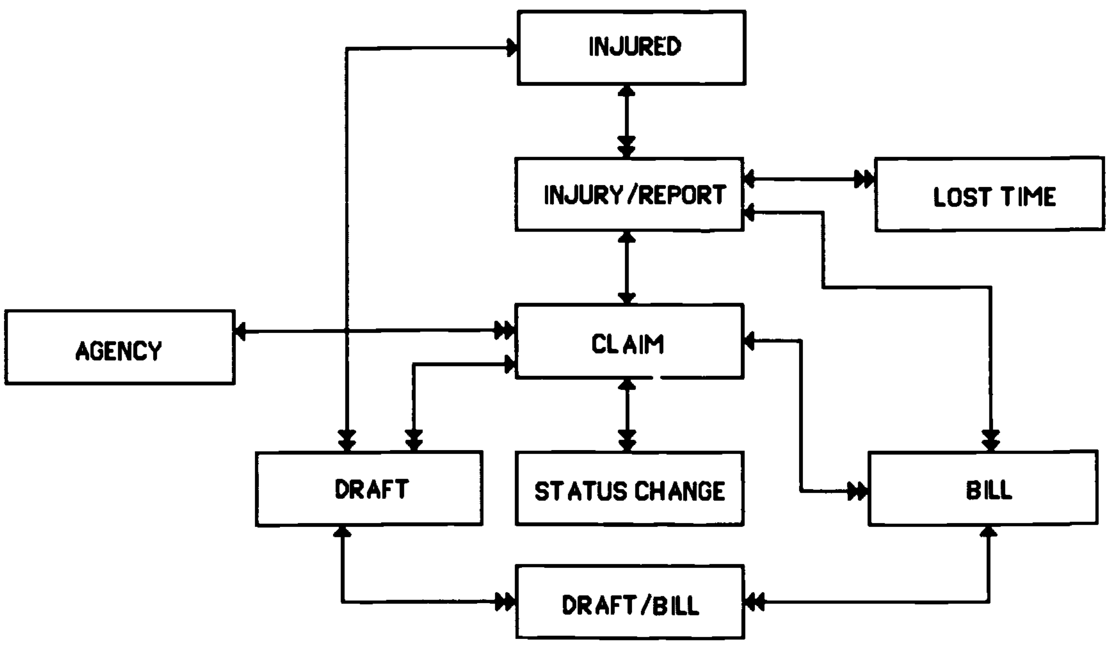


FIGURE 2

Once the data entities are enumerated, the data model is then populated.

First, the key to each entity is defined. The key is the unique value by which a set of data in the data entity is identified. For example, SSN might be a key of the Employee data entity.

Keys of kernels should be unique values which identify a particular set of data. Class Number, for example, might be a key to a Class table. The key to an association is usually a composite of the keys of the two kernels related through the association. The key to a Student-Class table which contains

grades, rank, etc... would be a combination of the student's SSN and the Class Number. The key to characteristic is usually the key of its parent plus some unique number or code. For example, SSN and Address Code might be the key of the Student Address table.

Once all keys have been identified, relationships are implemented by storing the key of a data entity on one side of the relationship in the data entity on the other side of the relationship. For example, to relate the instructor entity to the class entity, the key of instructor is stored in the class entity. Instructor would be a foreign key of the Class entity. The general rule of thumb is that the key of the entity on the "one" side of the relationship is stored in the entity on the "many" side of the relationship.

Case Study - Keys and Foreign Keys

The SWC Tables, Keys and Foreign Keys are listed in Figure 3.

SYSTEM WORKER'S COMPENSATION
TABLES, KEYS AND FOREIGN KEYS

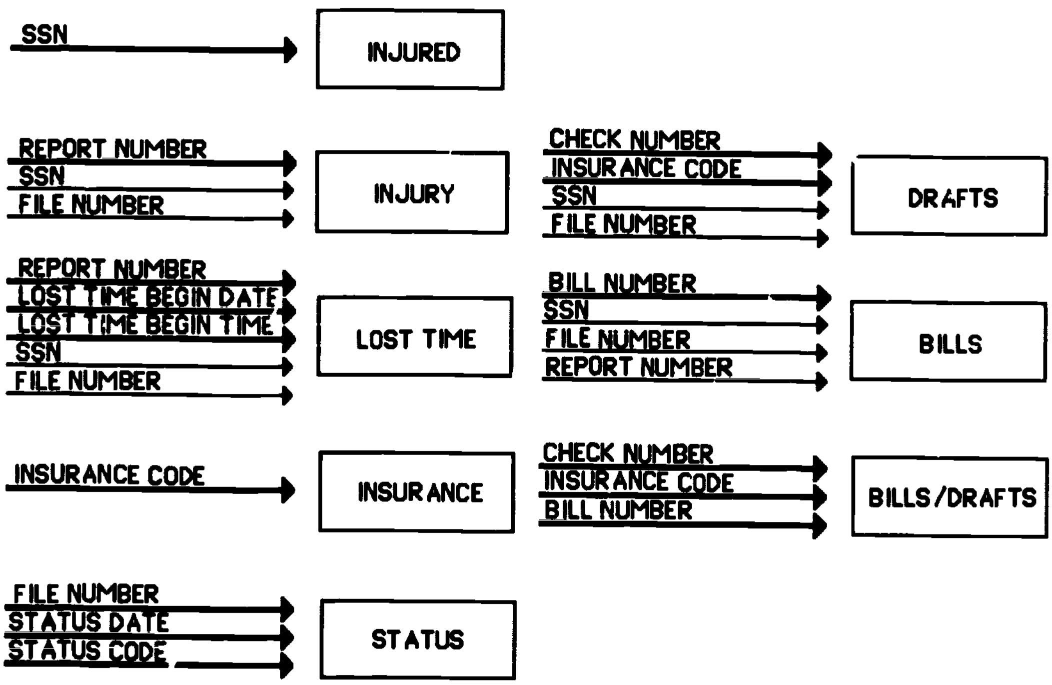


FIGURE 3

Once the keys and foreign keys have been identified, the project leader working in conjunction with his clients populates the data entities with non-key data. In populating the data entities, more characteristic data entities may be defined.

The Physical Data Base Model

The Physical Data Base is a model of how the data will physically be stored. It is at this point in the design that decisions on the data base type (IMS, DB2, etc...) and access methods are made. Work on the physical data base model can begin as soon as the conceptual data model is defined, even before it is populated.

In general, it is much easier to come up with a physical data base model in DB2 than it is in IMS. DB2 is a relational data base management system. A relational data base management system is one in which the data is perceived to be stored in tables.

Three considerations for implementing a data base in DB2 are tables, indexes, and data types.

1. Tables

   Each data entity in the Conceptual Data Model usually becomes a DB2 table. However, if two data entities are related in a one-to-one manner and one of the data entities is always created at the same time or after the other data entity, the two data entities can be stored in the same table without any loss of integrity or gain in redundancy.

   Case Study

   The following eight tables were defined in the SWC system:

   Injured, Injury, Lost Time, Status, Bill, Draft, Bill/Draft, Insurer

2. Indexes

   Indexes should be created on each key and foreign key identified in the Conceptual Data Model. In DB2, this is the minimum number of indexes that will be needed. Also, at this point, referential integrity rules should be established.

   Case Study

   At first, it seemed rather silly to put an index on some of the smaller SWC tables which were only a few tracks in size. The overhead for a DB2 index is rather high; for some of these tables the index would have been the same size as the table. However, when the system was transferred to production, there were some response time problems. Adding indexes dramatically improved performance. As a result, the decision was made to sacrifice disk storage space for performance. In the Worker's Compensation system, there are now seventeen indexes on the eight different tables.

3. Data Types

   In selecting the data type of each field in a DB2 table, one must consider the fact that the table will be used not only in a transaction driven environment but in an adhoc query environment as well. Character data is often easier to work with in programs but adhoc users cannot use arithmetic functions such as SUM and AVG on character data.

   Case Study

   An example of restrictions involving data types that had to be re-evaluated in the SWC system were date fields. These fields were stored as character and moved to numeric fields in the programs to compute the number of days between dates. This computed field was not stored. Later, when the users started writing their own adhoc queries, computing this field was not possible since the data types of the components were character. This restriction resulted in adding a new field to the table and storing the computed days for reference in adhoc queries. It should be noted that the Worker's Compensation data base was implemented before the date data type became available.

Once a DB2 data base design is firm and the tables populated, it usually takes less than a day at LSU to create the test data base and have it ready for use.

III. SUMMARY

It is important in developing and implementing new computer solutions to remember that the resource is actually the data. All the programs, reports, screens etc... are access paths to the resource (very important access paths but access paths nonetheless). Changing programs may sometimes be expensive and involved but changing data bases almost always is. Therefore, it is important when designing new computer systems to start with the resource - the data base. At LSU the importance of data base design has been recognized by moving it to the forefront of system design. Data base design is now done by moving the data base design to the requirements definition and external design phases of a project.

The Entity-Relationship approach to data base design is one method of designing data bases. The primary advantage of Entity-Relationship modeling is that it models what a business is about and not how the business functions. Therefore, data bases designed using the E-R approach should be more lasting and stable than data bases designed using other techniques.

What gives Entity-Relationship modeling its strength, however, is also what makes it rather difficult. Analysts who have worked on projects for a long time sometimes have trouble identifying the business entities. The problem is that, typically, analysts tend to ask and answer How: "How will claims be filed? How will drafts be paid?". In asking How?, the analyst gets wrapped up in policies and procedures that change over a period of time. Entity-Relationship modeling asks What: "What is a claim? What is the relationship between a claim and a draft?". The answer to WHAT? is the more stable and lasting part of the business. Thus, data bases designed through Entity-Relationship modeling should be more durable.

Another difficult thing about the E-R approach to data base design is that there is no correct answer. Generally, the best answer or model is the one that is most obvious; it is the model about which you say (after days or weeks of modeling the business) "Why didn't I come up with this in the first place?". At LSU, the modeling team works best when it is composed of representatives of the project team, the database team and possibly the user community. This works best because the project leader and clients contribute their knowledge of the business while the data base people contribute their objectivity and modeling experience. The Entity-Relationship approach to data base design which was presented here has become the accepted data base design methodology at LSU. Without the E-R approach, it would not be possible to have the number of data bases in development that now exist. It has eliminated much friction and led to a reduction in application development time.

Obviously, this presentation is just an overview; many interesting points and exceptions have been omitted. Either Professor Chen's monograph or the IBM Data Base Administration and Design class should be consulted for more complete details. The authors do hope, however, that this account of the Worker's Compensation Pilot Project will give you insight into the DB2 data base and application design process.

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INTEGRATING INFORMATION TECHNOLOGY
Prerequisites for Success

by Kenneth Blythe
Steven Watson

This paper describes the progress of two land grant Universities, Washington State University (WSU) and Penn State University (PSU,) in integrating information technology. WSU is nationally recognized for its use of data administration, CASE and software productivity tools. Both universities are administering heterogeneous computing environments involving IBM and Digital computing systems. Integrating this diversity requires new planning, new management and new financing techniques. Plans for integrated technology must be in keeping with the Universitywide business plan. Users play a much larger role in this strategy. Computing technology is being moved into the "culture" of the Universities with the acceptance of "data" as an institutional asset.

INTEGRATING INFORMATION TECHNOLOGY
Prerequisites for Success

by Kenneth C. Blythe and
Steve R. Watson

"If the word "excellence" is to be applicable in the future it requires wholesale redefinition. Perhaps: Excellent firms don't believe in excellence - only in constant improvement and constant change. That is, excellent firms of tomorrow will cherish impermanence - and thrive on chaos."

Tom Peters ***Thriving on Chaos***

Now it's the "baby busters." Just as we were growing comfortable with the surging population boom of post-war babies, we are faced with the scarcity of post-post-war babies; the so-called baby busters. In the next decade, workers will be a diminishing portion of the population. Those that work will demand better working conditions and better pay. Our nation will only remain competitive through improved productivity. Productivity will replace unemployment as our number one economic priority. Workers will produce more. They will know more and expand their knowledge throughout their careers. Job mix will change. There will be more knowledge workers and less factory workers. Careers will change frequently. The decade will be marked by rapid technological and societal transformations.

To keep up, workers will be in a continuous state of learning. Learning will not stop at age twenty-two. It will continue for life. Nontraditional, lifelong learning and retraining will be the norm. Higher education will respond by offering career-oriented education in nontraditional settings. The traditional, degree-seeking, high school pool will decline in favor of a new pool of nontraditional place-bound adult learners. Students will be served by invisible offices, invisible faculty in invisible classrooms

Higher education will not be able to avoid similar technological and instructional transformations. As Tom Peters explains, in his latest book ***Thriving on Chaos***, "If you are not reconfiguring your organization to become a fast-changing, high-value-adding creator of niche markets, you are simply out of step." Higher education will change. Technology, a peripheral concern in many institutions today, will move into the mainstream. Technology is both a field of instruction and a means of instruction. And it will certainly transform the administration of instruction. Never before has higher education been challenged to alter itself to the extent that it will be challenged in the next decade.

These are exciting times! As described by John Nesbett in his book Megatrends there are "ten major transformations taking place right now in our society. None is more subtle, yet more explosive, I think, than this first, the megashift from an industrial to an information society." We witness the birth of the information age. But, are we ready? Are we learning or merely observing the transition? Are we seeking new methods of instruction? Are we preparing ourselves for the changes that will surely come? At Washington State University (WSU) and Penn State University (PSU,) we are asking ourselves these questions. This is a report on the things that are underway at WSU and PSU which are preparing us for the next decade. This is a report of our attempts to integrate information technologies on our campuses.

ARCHITECTURE

Architecture is overused and often misunderstood. It is a symbolic word. It means that success in technology requires a vision; a carefully integrated plan. Like the architecture of a house, the architecture of an information system is integrated, efficient and functional. The pieces fit together nonredundantly. Architecture is contrasted to collage which is an assembly of diverse elements. Information systems that just "happen," without a plan, become a collage. Implicit in the word architecture is an intellectual process which anticipates future events and provides a framework within which those events will occur.

At WSU and PSU there is an information architecture. We are implementing technology on a changing field of play. The solutions that work today could be inhibiting in the future. Our integrated architecture is not a vision of where we are but where we are going. The vision is, of course, speculative, but there seems to be evidence that technology will tend toward greater homogeneity in the future. Information systems will be built around multiples of computer and communication machines provided by multiples of vendors. Standards organizations and vendors alike are providing products which are interoperable. This will increase in the future. To live in this future world, it is going to be important to have an architecture that surrounds this homogeneous environment. These are the key elements of the integrated information systems that will be implemented at WSU and PSU:

- Cooperative Processing - PSU and WSU are both multicampus institutions. PSU has twenty-two campuses and WSU has seven. An architecture is required to provide computing services at the central, distributed and local levels and at the same time preserve the integrated whole. WSU has already implemented a common signon which provides a single system image regardless of which processor is being used. Cooperative processing is with us and will continue to evolve. There are already more MIPS of computing available at the local level (micro and minicomputers) than at the central levels (mainframes). Central computers will become

information utilities with local processors handling the majority of the transaction processing cycles.

- Common Software Architecture - The glue which holds a distributed architecture together is software. How do you achieve a common user interface? With software. How do you distribute databases? With software. How do you provide end-user services? With software. PSU and WSU develop their administrative computing systems with the Software AG database and fourth generation language. The Software AG architecture, known as the Integrated Software Architecture (ISA,) has the benefit that it runs in a heterogeneous hardware environment with multiple operating systems. ISA provides distributed processing support for cooperative processing.

- Merging Academic and Administrative Computing - The business of higher education is academic. The functions of academic and administrative computing are different only in implementation. Early administrative computing applications were standalone as were early academic applications, but no longer. As the scope of computing expands and the goals grow more complex, it becomes necessary to draw the two computing disciplines together. Testing, counseling, advising, assessing, instructing and grading all have an administrative and academic dimension. In recognition that these two disciplines are merging, both WSU and PSU have joined academic and administrative computing (along with telecommunications) under a single university officer. The next step is to more closely associate the missions of these two computing activities. If administrative computing is to participate in the evolution of nontraditional modes of instruction, it will be by participating in the process of instruction itself.

- Data Administration - Data is an asset but its value is transient. It is useful for the moment that it is needed then its usefulness diminishes until it is needed again. Just-in-time information is as vital to higher education as just-in-time inventory is to automobile manufacturing. Data administration insures that useful (accurate, timely, secure) information is available at the time that it is needed in a form that can be used. In these days of cooperative processing, networking and software architectures, it is essential to have a strong data administration program. Data administration provides consistent business practices which facilitate smooth business operation.

- Computer Aided Software Engineering (CASE) - There is finally the question of quality and productivity. It seems that computing has been successful at improving the productivity of all disciplines other than computing itself. We are speaking here of software productivity. You would think that solutions in this area would be apparent, but they are

not. Washington State University and Penn State University are working with the Software AG fourth generation language NATURAL and the results are promising. Programmer productivity has definitely been improved, perhaps by a factor of ten. But, improvements in programmer productivity could be more than offset by the slowness of the front-end activities of conceptualization and systems design. Improvements here are based upon a new reality that end-users must become more involved in the design process. As Greg Boone, President of CASE Research Corporation observed, WSU has "made a discovery, which is quite contrary to established beliefs in our industry. They have found end-users quite capable of learning both analysis techniques and the use of CASE tools to support those techniques." At PSU and WSU, CASE tools are becoming the common denominator of communications; they assist in the design process. Soon, the results of these tools will be used to generate NATURAL programs from design statements.

These diverse parts of the technology puzzle do not simply fall into place. Leadership is required. The pieces must be installed one by one. No one can afford to pursue all pieces at once. Nor can they afford to ignore any piece. The sooner there is a recognition that an architecture is required, the sooner the institution will begin making progress toward integrating information technology.

LEADERSHIP

The transition to the information age is happening. The question is, who is in charge? Who is leading? Is anyone? Managers of Information Systems (I/S) have a special obligation, these days, to stay current in their field and fashion creative programs for bringing technology to their institutions. With limited resources, they must use their imagination to finance those programs that provide the greatest payoff.

I/S managers must know how to use I/S to compete. They must have vision and an architecture which implements that vision. Father Theodore Hesburgh, former Notre Dame University president, explained that "The very essence of leadership is that you have a vision. It's got to be a vision you articulate clearly and forcefully on every occasion. You can't blow an uncertain trumpet." (***Time, May 1987***) Information Systems (computers, software and communications) enhance the image of institutions and help them recruit and retain gifted students, faculty and staff. Information Systems also help to bring in research dollars and other revenues. Without up-to-date research tools (i.e., computers), it is not possible to compete effectively in the research marketplace.

Information systems undergird the administration of modern institutions and simultaneously streamline and enforce the way we do business. This is an advantage and also a disadvantage. On the plus side, information systems allow a university to use its limited staff resources more effectively. Large Universities such

as WSU and PSU could not function without technology to handle many of the routine administrative tasks. But, on the negative side, I/S can also become an inhibitor of change. For example, changes in academic calendars (from quarter to semester) are impeded if the information systems are based on a quarterly calendar. The information systems are actually a hindrance in this case. As long as you do things the same, I/S has been effective. In the future, it will be necessary for I/S to change more rapidly to keep up with the change in our institutions. I/S will only be adaptable if it is designed to be adaptable. Hardware and software must be adaptable from the start.

At PSU and WSU there is a definite trend toward end-user involvement in the design, development, operation and use of information systems. Computing is no longer the domain of a few organizations. It is a commonplace function that is invading every aspect of our institutions. End-users are becoming computer specialists in their own right.

The I/S organization will provide leadership in the future by influence, vision and judicious management of central resources; not by control. In higher education, end-users will continue to exercise a high degree of independence. If the I/S organization has an agenda that makes sense, end-users will follow. If it does not, end-users will pursue their own agenda rather than conform. I/S must lead or the institution will be bound for chaos. It must lead by example rather than by fiat. It must stay up-to-date with the issues and answers.

With the rapidly changing field of technology, there are no simple solutions. Yesterday's strategies are history. New strategies are required in these areas:

- New planning techniques - To achieve a coherent I/S direction it is necessary to achieve a shared vision with end-users; one that the end-users can support and I/S can deliver. The I/S plan must follow the business plan. This plan will leverage scarce people resources and achieve results by evolution rather than revolution. The plan would give highest priority to maximum value projects; those projects that have direct impact on the bottom line of the business.

- New management - Managers are required that recognize that the best solutions are those that contribute to the success of the institution. Hire individuals with a service orientation, not just technicians. The best people have both qualities. Resist the temptation to exclude ideas that were "not invented here." Decentralize expertise and measure success by the success of end-users. Make sure end-users are brought in before launching new initiatives.

- New organization structures - In view of these profound changes, I/S must be placed at a very high level in the organization. Any less and it will compromise the ability of the institution itself to make the hard decisions associated with automation. If in-house I/S is not at a high level, there is a

need for high level consultants (vendors, educators, etc) to step into the breech. Someone must be working with presidents and chief executive officers to influence change.

In higher education there is a special need to overcome the artificial separation of academic and administrative computing as if they are as different as black and white. We can no longer distinguish clearly where academic computing leaves off and administrative computing begins. There is an expanding area of gray.

- New understanding of costs - Computing equipment and software are not a once and done cost item. There are the obvious ongoing costs of backup, recovery, conversion, implementation and maintenance. There are also the people costs of motivation, information dissemination and training. We are particularly concerned about training. The best system in the world is useless without trained people to support it.

- New funding schemes - The more clever I/S managers are those that know how to maximize the impact of scarce computing resources. This can be achieved by working on the most important projects first and seeking alternative sources of funds to cover the costs. The most obvious source for offsetting costs is free or heavily discounted products from vendors. Another source is end-user funding or end-user participation in funding. There is also the opportunity of shedding services that are losing importance in lieu of those that are emerging. Fund sources or offsetting funds are available to those that seek them out. Successful institutions are doing that now.

- New relationships with peer institutions and vendors - Higher education is not alone in information technology. Japan is successful because it recognizes the value of relationships. We are too. PSU and WSU rely heavily on vendors to help with their most difficult challenges. They also work closely with peer institutions.

As you can see from these strategies, the basic principles of management are being rethought. I/S must have a plan. That plan must be realistic and must be agreed by those that have a "stake" in the outcome, the stakeholders. The plan must also recognize that no institution can afford the full price of technology and "creative financing" is required for the most important parts. We are learning, from experience, that the best institutions have an entrepreneurial spirit by which they generate some of the income needed to finance their programs.

CONCLUSION

At Washington State University and Penn State University, there is awareness of the need to move forward in computing to prepare for the next generation, the generation of baby busters. More important than employment in the next generation will be quality improvement and productivity. Our nation, our states and our institutions will have to become more productive to maintain our current standard of living and accommodate to the reduced number of workers coming into the work force. It is a real problem which demands real solutions. The computing industry, itself, is being held out as the bridge to higher productivity. If that is the case, and we are the practitioners and educators of computing, shouldn't we have some answers? How are we going to make an impact on our nation if we are not making an impact at home, in our own Universities?

At Washington State University, Penn State University and other higher education institutions, the search for integrated information technology is on. What does it look like? How will we know when we have it? We're not sure. But we think that it has to do with merging academic and administrative computing through cooperative processing. We think that it has to do with a common software architecture, data administration and computer-aided software engineering (CASE.) The challenge is to integrate these diverse concepts into a strategic plan which moves the institution forward. At WSU and PSU we are on the trail. A coherent picture is beginning to emerge, but it still has many soft edges.

AN IMPLEMENTATION STRATEGY FOR COOPERATIVE COMPUTING AND CAMPUS CONNECTIVITY

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Campuses are experiencing demands for the integration of personal computing, centralized computing, office automation, graphics services, data communication and libraries. Iona College developed ConnectPac to allow the user to access all services from a single personal computer. ConnectPac uses mainframe computing to support a campus computing network. The system integrates personal and centralized computing into a non-technical, menu-driven user environment. ConnectPac supports cooperative processing between the workstation and centralized computing facilities. It has been the foundation for the development of an information systems environment that transparently uses multiple computing platforms. Iona College is participating in a Joint Study with IBM Academic Information Systems to enhance and extend ConnectPac to support additional computing environments.

INTRODUCTION

In 1984, Iona College identified one of its strategic planning goals to be the integration of computing and information processing technologies in instruction, research, administration and student services. Today, the academic community routinely uses information systems, library and information services, external databases, electronic mail and office systems. These systems may use centralized computing, personal computers or a combination of both services. The convergence of technologies for computing, communication and information services has created an "information archipelago" from previously separate "islands of technology". However, this more powerful environment is also more complex. Non-technical users often found it overwhelming or difficult to work in this new environment.

ISSUES OF CAMPUS CONNECTIVITY

A closer examination revealed that many of the users' problems were associated with a fragmented computing environment. As computing continues to expand to multiple platforms, these problems will also increase. Services must be mapped to computing environments. Regardless of platform, users must have access to all appropriate data, software and peripherals. Users should see a workstation interface that is consistent across environments. These issues all address the connectivity of people to systems, services, data and other users.

Understanding how the user viewed this "information archipelago" was fundamental to any strategy for navigating it. The user wanted the workstation to be a window to all computing and information services. From this workstation, a user should be able to access any computing platform, computing tool, information system, or information service. The development of the ConnectPac system supports this user view.

ConnectPac CONCEPTS AND FACILITIES

The ConnectPac project began in 1986. At that time, computing was well established at Iona. All academic and administrative users had access to centralized services and personal computing. Most users were experienced in using a microcomputer as an independent system or as a terminal emulator. LANs had been installed in selected computing laboratories and academic and administrative departments. In developing a strategy for a campus backbone network, Computing and Information Services addressed human factors, technological and economic constraints. The campus network had to be user-friendly and increase the user's satisfaction level. It must provide acceptable

performance levels, be robust and reliable and be able to support a wide variety of microcomputer software. It must also take into account the dynamic nature of networking technology while attempting to provide a least-cost solution.

Iona's approach to a campus network assumed that its users were concerned with receiving network services rather than the specific methodology by which these services were delivered. The decision was made to take advantage of existing computing and communications facilities. In addition to supporting network-like services, ConnectPac would use centralized computing to provide a mechanism for navigating the information resources environment. The shift in academic computing from mainframes to microcomputers had created a new role for centralized computing.

Although users had the ability to use a microcomputer to access both PC and mainframe services, the user was responsible for managing this environment. He had to know the environments associated with each service and understand when and how to change environments. This type of environment did not encourage the use of computing by non-technical users. The goal was to develop an intelligent system which would assist the user in managing the environment. ConnectPac provides a transparent user interface to all computing and information services, regardless of the computing platform. In addition, the transparent mapping of services to environments allows a computing center to change the physical environment without impacting service to its users.

ConnectPac supports transparent cooperative processing between the workstation and centralized computing facilities through the following facilities:

- Single system image;
- PC software distribution facility;
- PC data management facility;
- Print distribution facility;
- User aids, editor and file management utilities.

<u>Single System Image</u>

The single system image component of ConnectPac integrates computing services across computing platforms and operating system environments. A single sign-on facility provides a user with access to all authorized computing services. The unified workstation interface is consistent across computing environments (PC-DOS, VM, MUSIC, VSE/SP) while providing integrated access to mainframe and PC applications. It also provides for integrated usage accounting for mainframe and PC services and facilities.

ConnectPac uses menus to access available software and services. Access to entire menus and/or specific menu entries may be controlled by password protection. The MAKEMENU utility allows an installation or individual user to tailor and organize menus to facilitate access to systems and services.

Software Distribution Facility

One of the more difficult problems in supporting personal computing is the distribution, maintenance, and upgrading of PC software. The distribution of PC software over a local area network did not resolve the problems of allocating software to multiple campuses, departments, and computing laboratories. With ConnectPac, PC software distribution was centralized. PC software is stored on the mainframe which acts as the file server. ConnectPac also collects usage accounting data to assist in the management of PC software. System facilities allow non-technical personnel to install PC software on the ConnectPac network.

ConnectPac's software distribution algorithm prevents the unauthorized copying and use of PC software. There is a facility to limit the number of licenses of software that may be in use at any time. Controlled software is encrypted and loaded directly into PC memory from the mainframe. Checks during execution prevent the use of controlled software outside of the ConnectPac environment. It is because of these controls that Iona College has received permission from software vendors to distribute PC software through ConnectPac.

Data Management Facility

The mainframe is also the file server for the user's PC data files. Each user may create, use and modify virtual PC disks on the mainframe. ConnectPac disks facilitate the sharing of PC data between users and systems. It also provides a mechanism for exchanging data between media type (5.25" vs. 3.5" formats) and uploading and downloading (ASCII and EBCDIC). Users need not individually backup their PC disks; ConnectPac virtual disks are archived as part of daily computing center operations.

The data management facility allows Iona to support a "paperless classroom". Faculty can place coursework materials or assignments on ConnectPac disks. Students can electronically receive these materials, complete coursework requirements, and electronically submit materials back to their faculty. This exchange between faculty and students can be repeated.

Print Distribution Facility

Providing users with access to printers also required thoughtful consideration. The increased use of word processing and desktop publishing generated increased demand for quality output. It became imperative to provide cost-effective access to laser printers, plotters and other special purpose devices.

ConnectPac supports the establishment of a mainframe-managed network of both mainframe and PC (ASCII) printers. Centralized information about printer availability adds flexibility in adding printers to the network or removing printers not in service. Access to "private" printers may be password controlled.

ConnectPac allows the user to dynamically change the preferred printer during a session. The print selection facility provides the user with assistance in choosing a printer: printer location; printer type; maximum output width; availability of graphics support; number of current users; size of print queue; and "estimated time of arrival" for a document at the printer.

User Aids

ConnectPac also supports a variety of user tools:

- Full screen editor;
- Utilities for PC directory and file management;
- On-line help.

ICEDT, the Iona College Editor, is a full screen editor that may be used to edit both PC (ASCII) and mainframe (EBCDIC) files. It supports block operations (move, copy, delete, write to a file), search and replace functions, undo line deletion and automatic backup of edited files. There is also an extensive on-line help facility.

Directory management facilities are available through FSDIR. FSDIR provides point-and-shoot support for the most commonly used PC-DOS functions: edit; copy; rename; delete; browse (type). It allows new users to become productive in PC-DOS without having to learn command syntax. File management utilities have been developed for frequently used functions. PURBAK erases .BAK files at the disk or directory level. BROWSE displays the contents of a file. MOVE renames files across subdirectories. FINDFILE identifies the path for a specific file name. FINDTEXT identifies the path and file name of all files containing a user-specified text string. BIWAY supports the uploading and downloading of files between the microcomputer and the mainframe. All utilities have extensive context-sensitive on-line help facilities.

On-line help is an essential part of the ConnectPac system. The policy regarding access to computing calls for computing to be available from any location on campus, remotely via telephone, twenty-four hours a day, every day. To support this level of usage, Computing and Information Services supplements consulting services with on-line help. The MAKEHELP facility allows publication specialists and user services to easily create context-sensitive on-line help.

DESIGNING APPLICATIONS FOR COOPERATIVE COMPUTING

The use of ConnectPac as the campus backbone network made it possible to review the design of the college's information systems. Computing and Information Services determined that administrative information systems, mail services, document services, and information services could be improved by taking advantage of the strengths of the different computing platforms.

Administrative Information Systems

The on-line registration system was the first application to use cooperative computing. The approach now being used calls for a microcomputer with a local printer and OMR reader to interact with the centralized data base and information systems. The student uses an OMR form to submit registration requests. The editing and verification of the requests is done locally at the microcomputer level. When complete, the application controls the transition from stand-alone microcomputer to terminal emulation. The student's registration is processed and the central data base is updated. The student's registration report is downloaded to the microcomputer. The application controls the transition back to stand-alone state where the report is printed. The state changes and processing are integrated and are transparent to both the students and the registrar's personnel. One significant advantage to this approach is the offloading of processing to local workstations. In turn, this increases the ability of the centralized facilities to handle the additional demand for administrative computing.

Executive Information Systems

The enterprise data bases reside on one processor which is not available to the entire academic community. The Electronic Fact Book and Executive Information System are more widely available and have been implemented on the academic processor. The data for these applications are extracted from the administrative data base. ConnectPac electronically delivers this data to the EIS system. Users may access the data, use microcomputer tools to summarize and present data, or make local copies of the data for

additional analysis. It is ConnectPac that presents these services to the users as a set of menus. Again, the users are insulated from the different state changes and control procedures. ConnectPac's password protection of menus and menu entries controls access to more sensitive functions and data.

Mail Services

Mail services are being expanded to include more than electronic mail. Work is underway to support the electronic delivery of physical mail. Another project in progress is the integration of distribution and receipt of FAX mail with the existing network of ConnectPac services. When these projects are complete, any ConnectPac user will be able to use scanners and local printers to send and receive physical mail. Users will also be able to send and receive a document (physical or electronic) through any FAX system on the ConnectPac network. Users will be notified that they have electronic mail, physical mail, or FAX mail waiting. At a later date, the plans are to extend this to also include voice mail.

Document Services

The ConnectPac network and the expanded mail services has made it possible to extend the scope of supported document services. As part of the ConnectPac Office Automation Project (ConnectPac/OA), the author of a document can electronically collaborate with co-authors and/or reviewers, both on-campus or off-campus. A library of documents, images, and boiler plates will be available. Revision and editing could be done by the author or a document processing center. Final copy could be produced by a document processing center using desktop publishing tools. The finished product could be published, reproduced or mailed to an electronically defined distribution list.

Information Services

Library services are currently available to the academic community. The college is using the NOTIS system which is available on a system separate from the environment used by faculty and students. However, the ability of ConnectPac to promote a single system image makes this allocation of systems to processors transparent to the users. Accessing the library system is simply another choice on a ConnectPac menu. Again, the system handles the changes from one computing environment to another. It also returns the user back to the point from which the library system was accessed.

There are plans to add external data bases and CD-ROM data bases to the scope of supported ConnectPac services. There are also plans to support peer-to-peer communication which would allow a user to access a librarian from a workstation and receive assistance in doing reference or research work.

CONCLUSIONS AND RECOMMENDATIONS

The increased use of computing and information services and multiple computing environments presented a considerable challenge for technology management. The ability to present the users with a set of integrated, user-friendly services has increased the number of computing users and the extent to which computing and information tools are used in problem solving.

In order to achieve this goal, the college developed and implemented a flexible campus backbone network and a mechanism for allocating services to computing platforms. The development of a user interface to control the environment and promote cooperative computing was a fundamental part of this project. The ability to deliver information technology resources to the user's desktop is becoming a reality.

There are also institutional benefits to these directions. The connectivity project has promoted greater productivity among faculty, students, and administrators. It has supported and promoted the diversity of academic interests. While allowing individuals to optimize their own interests, it has helped to minimize institutional costs.

Rensselaer Libraries Online Information System

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New York

Rensselaer Libraries Online Information System, INFOTRAC, runs on the campus mainframe computer on SPIRES Software. The system is more than a traditional catalog of books and journals, including records for slides, sound recordings and software and also including information on items which may not be in the libraries holdings. The system is available on the campus network and through NYSERNet.

The libraries holdings and access to remote bibliographic databases are an important part of the information techology which must be integrated into campus planning in order to meet academic and administrative campus needs.

RENSSELAER LIBRARIES ONLINE INFORMATION SYSTEM

Our conference theme is the effective integration of information technology within the framework of institutional objectives, i.e. Making it all fit. I will be talking with you today about a piece of information technology that has often not fallen within the purview of computing on many campuses, and yet, which many, of you will probably be involved in integrating into your campuses information technology in the not too distant future. This piece of information is primarily bibliographic information, and moved into the campus information technology arena in the 80s, when libraries began to make bibliographic information available on campuses through online public access catalogs (OPACs).

In the early 80s Rensselaer made some decisions that today place our system in the forefront of those integrated with other information resources on campus. I wish I could say that we had had a clear plan in place at the time, and that that is what brought us to this fortunate current placement. That is not the case. Then, as now, we were dealing with a rapidly changing technological environment and long-range planning was and remains difficult. In the early days we were responding primarily to financial constraints and the state of library automation. Now, aware of our position, we are capitalizing on it and using it to advantage in out institutions strategic planning process.

This morning I will describe for you where we are, how we got there, and future planned areas of integration of both bibliographic and non-bibliographic resources, both on and off campus.

WHERE WE ARE

When you sign on to our system today you see the following welcoming screen.

```
                    WELCOME TO INFOTRAC
            RPI Libraries' Information System

To look for BOOKS................................type CATalog
To look for JOURNALS.............................type JOUrnals
To look for NEW BOOKS............................type ORDers
To look for HOMEWORK ASSIGNMENTS.................type HOMework
To look for ARCHITECTURE SLIDES..................type SLIdes
To look for IEEE articles or papers..............type IEEe
To display library NEWS bulletins................type NEWs
To send us a MESSAGE.............................type MESsage
 o END session...................................Type STop
```

Note that the welcome is to the Libraries <u>Information</u> System, not to its catalog. Only two of the files contain what most other OPAC's do, i.e. the book and journal holdings of a library. Libraries traditionally cataloged their books and journals and this is what typically appears in OPACs. When libraries automated their paper bibliographic records they typically converted their card catalogs to electronic format. Other information formats such as television tapes, database tapes, phonograph and sound recordings, microforms, and slides were not typically found in card catalogs and hence are not typically found in OPAC's either.

Our system currently contains records for photographic slides. The SLIDES file represents bibliographic records for our large collection of art and architecture slides, one of those formats not typically included in catalogs. The slides were indexed using the Getty Art and Architecture thesaurus, and records were entered into the online system.. The users now have access to any piece in the collection from multiple points, not simply from a single one such as geography or architectural feature, as they did in the manual systems.

The slides file contains bibliographic records for a format not typically found in library catalogs, and it is possible because of our committment to eventually make bibliographic records for all formats available in the catalog. Attempting to find something on cave painting yielded this record.

TITLE	Cave drawing, Font-de-Gaume Reindeer, photo
SUBJECT:	Cave Drawings Caves at Font-de-Gaume paleolithic, Magdalanian culture wall painting, Upper Paleolithic, Pre- historic Drawing, Cromagnon
SITE:	Les Eyzies-de-Tayae, Dordogne, France
DATES:	15000BC - 8000BC mural Franco Cantabrian
SIZE:	3.5 x 4 in b&w
CALL NO:	0:3

The next file, IEEE, represents information that patrons have long desired in library catalogs, i.e. article level access to periodical articles and journal conference papers These have typically been provided outside of the library catalog, originally in print reference tools called abstracts and indexes, and more recently as online databases, which were originally offshoots of the printing process for the paper tools. Until very recently libraries accessed these remote databases for individual patrons in response to a specific search request. The most recent development is that the producers may lease tapes to the campus or provide service directly to patrons, typically with simplified, or user-friendly search software. The tapes may be housed for campus access on the campus mainframe or on a library computer. This is one of those areas in which library and computer center functions have begun to converge.

Here are some of the records that a search for information on computer aided design turned up in the IEEE file.

Welcome to IEEE

IEEE is a database listing journal articles and conference papers of the Institute of Electrical and Electronic Engineers. Currently dating from January 1988, IEEE will be updated and continue to grow.

IEEE differs from the other INFOTRAC databases in several ways:

* IEEE includes abstracts of conference and journal papers.
* IEEE includes some material that is not owned by the Library
* IEEE does not always list a call number for a title that is owned by the Library.
  While call numbers are always listed for IEEE journals owned by the Library, they are not listed for the conferences. You have to check the CATALOG database to see if the Library owns an IEEE conference.

NO.	DATE	PUB.	TITLE	BY
1	Nov 87	IECON	An AI approach to computer aided design	El-Dessouki
2	Nov 87	IECON	Computer aided design	Furuta
3	Nov 87	IECON	Computer aided design of electrical mach	Krishnan
5	Nov 87	MONCPN	Design considerations for computer aided	Pruufer
6	Nov 87	IEMBS	Use of a computer aided design in pharma	Segui
7	Oct [illegible]	ICSMC	The computer aided design of real time s	Ammar
9	Dec 87	MICRO	A computer aided design automated syste	Chen

BY: Krishnan, R.;
Aravind, S.;
Materu, P.;

TITLE: Computer aided design of electrical machines for variable speed applications 87 IECON

CONFERENCE: International Conference on Industrial Electronics, Control

PLACE HELD: Cambridge, MA, USA (11/03/87 - 11/06/87)

PUB. DATE: November 1987

CITATION: p. 756 - 763

ABSTRACT: The development of interactive software for the design of a motor intended for variable-speed applications is presented. The use of finite-element analysis methods is proposed as an indispensable part of the computer-aided design (CAD) system for electrical machine design. An illustration of the method is given for the design of a switched reluctance motor.

REFERENCES: 25

In providing journal article access the way is opened to providing access through the information system to items that may and or may not be in the collection because most of the files are produced by database producers such as IEEE, Chemical Abstracts, etc. and made available either through the producer or a database vendor such as BRS, DIALOG, STN. Hence this is no longer a catalog, or list of library holdings but represents a return to something librarians have long called a bibliography, i.e. a listing of books, journals or articles on a certain subject.

MESSAGE is another unique feature of the system which permits interaction with users. A library user can send the library mailbox a reference question or criticize the system, which they often do. (I use criticize in the true sense, ie. to judge or evaluate.) The users point out features they like and let us know where they think the system is lacking. We do pay attention and have made system enhancements suggested by users.

What is unique about our system? Several things.

1. It is more than a catalog. As I have pointed out, it includes some formats normally not cataloged which are in the library and it contains reference to items that may not be in the library.

2. The second unique feature is that the system is available to users throughout campus. The catalog has not only become an information system, it has moved out of the library. INFOTRAC runs on the campus mainframe, an IBM 3090D, on SPIRES database software. It can be accessed either as a mainframe file or through a Network server, providing no charge access to the database. Most other OPACs, in addition to being JUST catalogs, are purchased through a library vendor and run on a separate computer which is installed in the library (or sometimes in the computer center) or is at the vendors and is accessed through telecommunications. The library must accept whatever search capabilities the vendor provides and users must access the system in the library or are limited to a small number of dial-in ports for remote users. At times there may be 30 or 40 users accessing INFOTRAC.

HOW DID WE GET HERE?

How did we become an information system accessible throughout the campus? First we decided very early on to put as many of our catalog records as possible in machine readable form. Back in the late sixties librarians envisioned that the computer would be a much better way to store its bibliographic records than 3" x 5" inch cards. We developed the MARC record. MARC stands for machine readable catalog record. This is a standard format that specifies where all the elements of bibliographic description and subject terms which may be in a bibliographic record should be. Originally this was developed for books and journals, and, more recently for all formats acquired by libraries, e.g. software and manuscripts and allows Rensselaer and all other libraries to include their format in their catalogs. This standard MARC record then allowed us to catalog cooperatively, to compile our own records for further manipulation, and eventually to share or transfer records.

This progress was possible cause we embraced new technology as it was developed for other fields. As Kenner[2] said, "One lesson the past has to teach is that every new technology, when it applies for admission to a citadel of the intellect, has invariable received its first welcome from the librarian." So we embraced telecommunications, and the OCLC and RLIN networks were born. Librarians located records from or contributed cataloging records to central locations via telecommunications, and the OCLC and RLIN databases have grown since the early 70s to their present sizes of more than 18 million records each. Libraries were able to locate information about books and journals and request the actual items electronically, thus greatly improving resource sharing. But, for the most part, access to these databases remained in libraries, used by catalogers first, then interlibrary loan librarians, and then, within the last few years they were made available to library searchers as remote databases through database vendors. The librarian remained for the most part as a gatekeeper, accessing these resources for the user.

In the 80s libraries began to use the cataloging records which they had contributed to OCLC or RLIN and stored on magnetic tape, to produce local OPACs. At the same time that this was happening in library land, computer centers were experiencing the growth of the use of personal computers on our

campus s. Users wanted to be able to have computing power at their finger ips on a desktop machine, and to use the same desktop machine to access the mainframe whcn greater computing resources were required. Campus networks began to emerge.

WHERE ARE WE GOING

Now library information networks and campus computer networks usually exist independently on campus. Rensselaer's placement on the campus computer makes us available to scholars in a way similar to the campus mainframe and the files or software available to them through the mainframe.

This record, for example, shows that this title is not charged out and that the user can expect to find it on the shelf if he decides to visit the library.

BY:	Corbin, John Boyd
TITLE:	Managing the library automation project
TITLE-NOTE:	John Corbin
PUBLISHED:	Phoenix, AZ: Oryz Press 1985
SUBJECT:	Libraires--Automation
CALL NO:	Z678.9 .C635 1985
OCLC NO:	1234285
LC CARD NO:	85-15461
ISBN:	089774151X
DESCRIPTION:	vi, 274 p. : ill.; 24 CI
NOTES:	Includes index. Bibliography: p. (261) - 267.

BARCODE	COLLECTION	DESCRIPTION
1769090W		

COPY	STATUS	DUE DATE
	AVAILABLE	

The library has moved out of its building and joined the other information resources on campus. This is making possible some new connections. RPI libraries are presently pursuing 2 tracks: the first is expansion of the information system to include campus resources that are not in the library, both book and non-book resources. People from other units on campus have begun to approach the library, asking for assistance both in organizing cheir own databases and in making some of their resources available through the system. The obvious advantage for the scholar here is that he/she would have access to a multiplicity of resources using the same system and search software.

Let me give you 2 examples. The Career Development Center has a collection of books, pamphlets and articles about job hunting, resume writing, interviewing, etc. The Library also has similar materials. The Career Development Center has asked to have their resources listed in our system. We have also been approached by the Registrar to make the Schedule of Classes and the Course Catalog available online, and the bookstore has asked us for help in adapting our online acquisitions system for their use.

Librarians have great skill in the organization and retrieval of bibliographic information, but there is a great deal of carry over possible to the organization and retrieval of other types of information as well. Here of course we may overlap with functions that have typically been the responsibility of either the computing center or administrative computing, if a separate unit exists. The scholar has a large number of information pieces which he may need to integrate. Schematically they look something like this. See Figure 1, page 8.

The second track which we are exploring is to take advantage of our membership in NYSERNet to bring formerly remote databases to the scholar's desktop, not, as many libraries are, by leasing tapes and mounting them locally, or by subsidizing searching on the remote services such as BRS AFTERdark or DIALOG's Knowledge Index, but by providing direct terminal to terminal access through the network. Let me give you a little background.

NYSERNET, part of the NSF Internet, is a high speed telecommunications network that links universities and industries within New York State providing electronic mail, access to the Cornell supercomputer, teleconferencing, and promises library research and remote education. I am chair of the NYSERNet Information Resources Committee, which has responsibility for recommending what library resources should be available on the network. We have made a recommendation that NYSERNet pursue making 4 information tracks available over the network directly to scholars.

Track 1	Track 3
National Bibliographic Utilities OCLC	Non-Bibliographic Databases United States Patent and Trademark Office Classification Database The New York State Census Database New York State Legislative Retrieval Service
Track 2	**Track 4**
Bibliographic Databases BRS DIALOG	Library Catalogs New York State Library

At present the Network is in active negotiation with BRS to make its product available over the network and with OCLC to make the new reference product available. The reference product is the entire OCLC online Union Catalog, with holdings, with a user-friendly front-end interface.

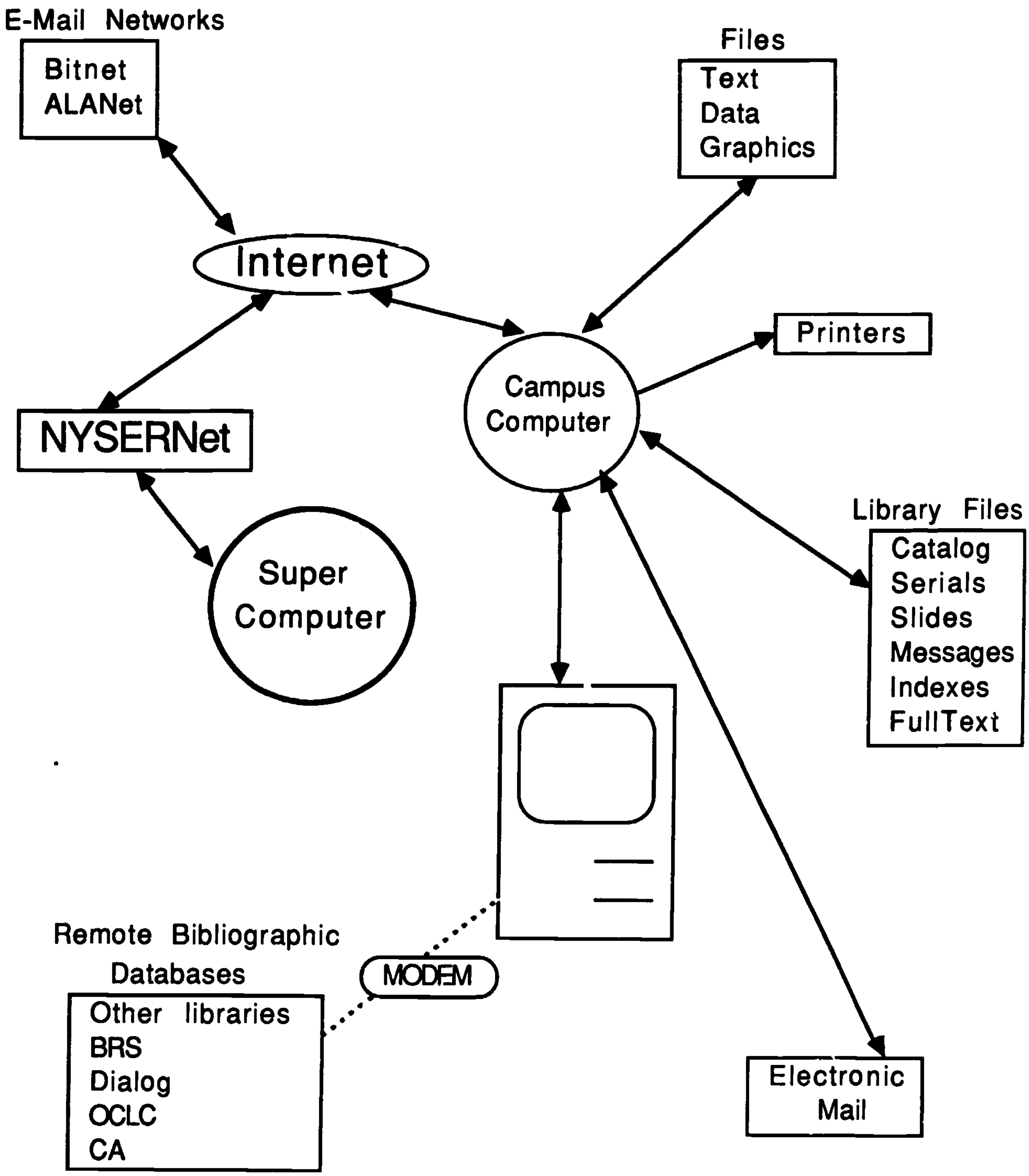
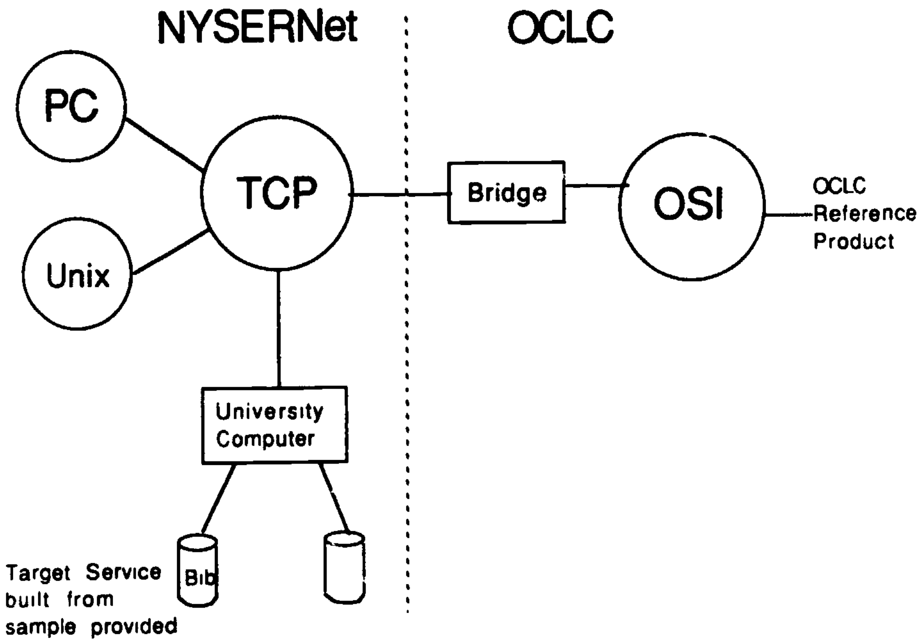

E-Mail Networks
Bitnet
ALANet
Files
Text
Data
Graphics
Internet
Printers
Campus Computer
NYSERNet
Library Files
Catalog
Serials
Slides
Messages
Indexes
FullText
Super Computer
Remote Bibliographic Databases
Other libraries
BRS
Dialog
OCLC
CA
MODEM
Electronic Mail

Figure 1

Before these databases can be made available to the scholar it is necessary that NYSERNet complete a missing link. NYSERNet is a TCP/IP network and, in order for the OCLC reference product to be available it is necessary that there be a bridge between the ISO/OSI protocols of the library community and the TCP/IP protocols of the NSF Internet of which NYSERNet is a part. NYSERNet has almost completed work which will allow direct computer to computer transmission of bibliographic data using the Z39.50 Information Retrieval Service Definition and Protocol Specification for Library Applications between TCP/IP networks (which NYSERNet is) and the library networks which are primarily (or soon will be) ISO standard. This work will permit direct computer to computer transmission of bibliographic information on existing networks before migration to the ISO standards is completed. Diagramatically that looks like this.



The work should be completed early next year. When it is, the separate access line labeled MODEM in figure 1 will be eliminated and the scholar will not have to have a separate contract with the database vendor or come to the library to use a terminal, thus bringing another wide range of bibliographic services to the user's workstation.

CONCLUSION

Having the library's information system available on the local campus network and remote bibliographic resources available to scholars on the Internet is going to change user expectations not only for library service, but for other information resources. I expect that the 90s will see a great deal of collaboration amongst library and computing services staff.

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THE UWSP M-SYSTEM:

TOOLS AND A TURNKEY SYSTEM FOR A COMPLETE ACADEMIC NETWORK OPERATING ENVIRONMENT

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University of Wisconsin
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Wisconsin

ABSTRACT

During the past four years, The University of Wisconsin - Stevens Point (UWSP) has developed software to provide a menu driven environment for its computing network. The system is designed to meet the special computing needs of faculty and students. Grant support from AT&T has made it possible to move the software from a series of in-house tools to a fully documented product and place the resulting system in the public domain as the "UWSP M-System".

The M-System solves many problems encountered in creating an academic network. With this system someone with little network experience can set up and manage a fully functional academic network. Our presentation will consist of an overview and demonstration of the system.

OVERVIEW

The UWSP M-System was developed over a period of four years to provide an operating environment for the campus network at the University of Wisconsin - Stevens Point. The M-System was developed for the AT&T Starlan network, but the ideas are applicable to any network environment.

Special care was taken in the development of the M-System to insure that it would meet the needs of a wide range of potential users.

> The Turn-key System is designed for setting up and running a computing laboratory where there is little computing expertise beyond a basic knowledge of MS-DOS. Network software, with a default set of operational menus, can be installed and made operational in less than two hours. The network administrator can then learn how to customize the network while it is in operation. The documentation contains simple step-by-step instructions for beginning users.
>
> The M-System can also be viewed as a set of modules or tools, any of which may be used to help run a network. The documentation includes complete information, including many diagrams, showing how the modules function.
>
> For advanced users, source code is available so that the modules may be modified as desired.

Most network software is designed primarily to facilitate shared access to databases and peripherals. Network users gain access to data or disk space by using accounts and passwords much as they would on a timesharing computer. An individual user usually has access to only a small number of network services. The feeling is that of a closed system with access only to the privileged.

In an academic environment the primary use of the network is to provide software service and access to processors information. The feeling should be that of an open system which invites widespread use. Most network users can store their data on floppy disks or their own hard disks so that it is not necessary to have an elaborate account system.

The UWSP M-System was designed specifically for the academic environment. The menu system clearly displays all of the network services and invites use. At the same time the System protects the software and the network from tampering; creating an open, but protected, environment.

DESCRIPTION OF THE M-SYSTEM

The UWSP M-System is an MS-DOS workstation based software package along with documentation. The M-System software runs over the server software to create a menu-driven user environment specifically designed for an academic computing network. The M-System also provides a menu-driven environment for the network administrator. In addition, the documentation gives step-by-step

instructions for initial setup of an academic network along with a wealth of information on developing and maintaining the network.

The M-System was developed to run on the AT&T Starlan network. Source code is available and users are welcome to modify and adapt the system to meet their needs. The system is quite modular and several parts may be used individually without using the entire system.

FEATURES OF THE M-SYSTEM

Simple Installation

The UWSP M-System along with the server software can be installed on an AT&T Starlan network in less than two hours. Instructions can be carried out by anyone with a basic knowledge of MS-DOS and some experience with MS-DOS based computers.

User Menu Environment

Upon completion of the installation process, the network has a default set of menus running. The Main Menu will appear as follows:

```
17:13:42                                                    11/6/2000
                  Welcome to the Campus Network System

                           M A I N   M E N U
                           -----------------

                  ==>  Applications Menu
                       Courseware Menu
                       Program Development Menu
                       Terminal Emulation Menu
                       Printer Association Menu
                       DOS Utility Menu
                       Exit to DOS




F1 - Help                 F9 - Exit               Return - Selects Item
F10 - Main Menu       Default Drive A:            ↑ or ↓ - Changes Selection
```

Go to the Applications Menu (word processors, databases, spreadsheets, etc).

The Utility Menu has a complete set of selections all of which are active after the installation process is complete.

```
 9:56:58                                                     11/21/2000
                     Welcome to the Campus Network System

                     D O S   U T I L I T I E S   M E N U
                     ------------------------------------

                         Previous Menu
                         Display a File Directory
                         Erase a File
                         Rename a File
                         Copy a File
                   ==>   Change The Default Drive
                         Format a Diskette
                         Duplicate a diskette




F1 - Help                  F9 - Exit              Return - Selects Item
F10 - Main Menu         Default Drive A:          ↑ or ↓ - Changes Selection
```

Change the drive DOS recognizes as the Default disk Drive.

The network administrator will add software to populate the remainder of the menus. Additional menus may be added and existing menus modified by using the Menu Editor which is described below.

Menu-driven Administrative Environment

The network is administered from a special menu called the Tools Menu. From this menu the administrator edits the menus, adds software to the network, adds printers to the network, and performs other administrative tasks. The Tools Menu appears as follows:

```
13:47:26                                                  9/13/2000
                  Welcome to the UWSP M-System Tool Menus

                            T O O L S   M E N U

                   ==>  ADMIN Login to server
                        Edit Menus
                        Install Run Files
                        AT&T StarLan Commands Menu
                        Editor
                        Edit Printer Menu
                        ADMIN Logout of server
                        Test Menus
                        Monitor Licenses
                        Edit System Configuration
                        Exit to DOS

F1 - Help                 F9 - Exit            Return - Selects Item
F10 - Main Menu       Default Drive A:         ↑ or ↓ - Changes Selection
```

Log in as ADMIN on the server defined in the system configuration file.

The functions of several of these selections are described below.

Menu Editor

At first glance the Menu Editor looks like any other menu on the system.

```
17:32:05                                                  11/6/2000
                        Menu Editor, Version 2.00

                            M A I N   M E N U

                        Applications Menu
                   ==>  Courseware Menu
                        Program Development Menu
                        Terminal Emulation Menu
                        Printer Association Menu
                        DOS Utility Menu
                        Exit to DOS

F1-Help        F3-Add Entry   F5-Modify Entry     F7-Move Entry Up
F2-Save Menu   F4-Del Entry   F6-Chg Menu Name    F8-Move Entry Dn   F10-Quit
```

Go to the Courseware Menu (tutorials, simulators, class specific programs).

However, further examination reveals that the function keys may now be used to edit the menus. The menu editor is used to add new selections, change the menu name, add new submenus, and, in general, customize the menu structure. The process of creating menus and selections is very visual and interactive. New menu selections are active upon leaving the Menu Editor.

The process of adding a new menu selection is just a matter of pressing <F3> and then filling in the blanks on the screen as the following example shows.

```
Menu entry name: [illegible]          Entry type: External Command

                 Short description of entry:
[illegible]

Name of help file: [illegible]

Command to be run: [illegible]

First optional prompt for input:
[illegible]

Second optional prompt for input:
[illegible]

Third optional prompt for input:
[illegible]
```

Software Installation System

The M-System provides tools to aid in the installation of applications on the network. Applications are installed in a systematic way using a step-by-step process detailed in the documentation. The installation of each application is documented using a standard format so that modifications may be easily made at a later date, if necessary.

The Run File is a file created by the M-System to connect a menu selection to the software to be run. The Run File also contains information on licenses which are discussed later in this paper. The information in the Run File is encrypted so that network users cannot find the location of the software and the password of the shared directory. Run Files are created by filling in the blanks on the screen as the following example shows.

```
                 Run File Installation Program, Version 1.01-B1

Full path and name where the run file should be placed:

Shared directory where application is located:

Password for shared directory:

Should this application be licensed

Number of licenses for this package:

                         Install this run file (Y/N)?
```

The documentation has an appendix containing Application Installation Kits. These kits contain detailed information on installing specific applications. If a kit is available for an application, the installation is a routine process, since the kit provides solutions to problems which arise in the installation of that application. M-System users are invited to submit Application Installation Kits for applications not already supported so that they may be shared with other users.

Unfortunately, the installation of applications on a network is generally not a straight forward process and there are often problems of various kinds that arise. The M-System deals with these problems by establishing a regularized procedure for installing applications and providing Applications Installation Kits as a means of sharing solutions to installation problems.

License Control

The M-System provides a mechanism for controlling the number of active copies of an application on the network. When an application is installed, the number of licenses is given. The M-System keeps track of how many copies are active and, when all licensed copies are in use, it informs the next user that all copies are in use and suggests trying again later.

The license control feature makes it possible to provide software on the network without a site license. In many cases just a few copies are sufficient to serve a large number of users. Using this feature, the network may also be used as a mechanism for delivery of a software evaluation library.

The License Monitor provides for real-time monitoring of network activity. The monitor, which is available from the Tools Menu, is shown in the following:

License Monitor Version 2.00-B1

License File	No. Lic	In Use	Used	Errors
DBASE.LIC	5	2	0	0
MTABF.LIC	15	0	2	0
MTABS.LIC	9	0	1	0
FRAMEWRK.LIC	14	0	1	0
SYMPHONY.LIC	14	0	2	0
[illegible]	1	0	0	0
ASM.LIC	3	0	0	0
UCAD.LIC	10	0	0	0
CORE.LIC	5	0	1	0
SIDEWAYS.LIC	1	0	6	2
LEARNDOS.LIC	10	0	0	0
FLOPYDOS.LIC	10	0	0	0
HARDDOS.LIC	10	0	0	0
PYXELVI.LIC	10	0	3	0
PYXELBP.LIC	10	0	1	0
OVERHEAD.LIC	10	0	3	0
ENGRAPH.LIC	10	1	11	0

F1 - Help

F2 - Chng in use count

F3 - Chng No. licenses

F4 - Print report

F5 - Clear all stats

F6 - Delete lic. file

F10 - Exit

↑ ↓ - Change highlight

The License Monitor gives the numbers of licenses owned, the number currently in use, the number of times the application has been run since the last time the statistics were reset, and an indication of when it is time to purchase additional licenses. The Monitor can handle any number of applications by scrolling them through the on-screen window. A complete report of license usage can be printed at any time.

PC Type Identification

The M-System is able to identify the type of graphics board on a network PC so that the proper software configuration will be sent to each client station. This eliminates having to ask the user (the user often doesn't know) and makes it possible to have computers with several types of graphic boards coexisting on the network.

Terminal Emulation

Terminal Emulation may be used to access a Unix based server on the Starlan network or any processor attached to a terminal server.

The documentation provides instructions for using Kermit to support various terminal emulation activities. Kermit is available for cost of reproduction and materials from Columbia University. It has built in support for the Starlan network.

Kermit includes scripting capability which makes it possible to redefine the keys to match various terminals or the needs of a particular application. The

scripting may also be used to take a user from an M-System menu selection to an application on a network processor (i.e., it can call the computer, login, and run the application; e.g., an on-line library catalog.). Scripting is a powerful mechanism for maintaining user friendliness in the M-System when under terminal emulation.

Printer Association

The Printer Association Menu is available from the default Main Menu. From this menu, users may link to any network printer which has been allowed by the network administrator.

```
            P R I N T E R   A S S O C I A T I O N   M E N U

    Exit with no changes          > Local Printer
    Printer1                        Science1
    Plotter1                        Science2
    Plotter2                        Laser1
    Plotter3                        Laser2
```

The Printer Association Menu is administered with the Printer Association Editor which is accessed from the Tools Menu. The network administrator names the printers and places them on the menu through this editor. A password may be used, if desired, with any printer to control access.

CONCLUSION

The UWSP M-System is a software package, along with documentation, which may be used in a variety of ways in the installation, development, and maintenance of academic computing networks. The package may be used as a whole to install a "turn-key" system or parts of it may be used separately. Using available source code users may modify the programs to meet their needs.

It is our hope that by using this system, campuses will be able to avoid "re-inventing the wheel" and will be able to build on the solutions provided in the System to provide more and better services to their users.

CCNEWS: An Electronic Newsletter and Articles Database

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CCNEWS: An Online Forum for Campus Computing Newsletter Editors is a service of EDUCOM that combines a weekly electronic newsletter with an articles database. Over 750 subscribers in the United States and abroad find in CCNEWS a peer group communications medium, a mechanism for improving their own publications, and a glimpse into the future of electronic publishing.

On April 8, 1988, EDUCOM sent the first issue of CCNEWS, an electronic newsletter, to 78 subscribers. Two weeks later the subscription list had nearly doubled, and within three months it exceeded 450 subscribers. After nine months of publication CCNEWS is still evolving, yet this experiment in information sharing offers valuable insight into the future of networking and information dissemination.

Developed by EDUCOM as a membership service, CCNEWS combines an online weekly newsletter for campus computing newsletter editors with an articles database. Thus CCNEWS provides both a forum for editors to discuss design, writing, editing, production, and distribution of newsletters (Appendix 1) and a database from which relevant articles can be retrieved for research or reprinting (Appendix 2). In addition, a calendar of events (Appendix 3) has been added to assist editors in reporting on relevent conferences, seminars, and workshops. The newsletter is distributed, and the archive and calendar are accessed via BITNET, the academic network that now connects over 700 campuses in 30 countries.

CCNEWS is based on the "moderated list" format of LISTSERV, the mailing list/ file server software available on many IBM host computers on BITNET (Appendix 4). Moderated lists enable an editor to intercept and filter messages intended for a group; many editors assemble the messages into occasional digests or regular newsletters. Unmoderated lists, on the other hand, tend to be more freewheeling, since every message is sent to the group immediately, without editing or selection; although subscribers may appreciate the immediacy of an unmoderated list, they risk an onslaught of irrelevant messages (each with its own lengthy mail header).

Subscribers are encouraged to send questions, comments, and suggestions, which are compiled by the EDUCOM Publications staff into the weekly newsletter, as well as complete newsletter articles and other materials, which are archived for possible retrieval. A brief abstract of each archived entry is included in the newsletter, but the full text is sent only on demand. In addition to newsletter articles, the archive includes sample stylesheets, book reviews, and brochures. Claudia Lynch from the University of North Texas envisions, "CCNEWS serving as a vehicle from which I can gather articles for reprinting in my newsletter and from which I can gain inspiration on research topics I might otherwise have ignored."

Discussions in CCNEWS have ranged from desktop publishing, graphic design, and electronic publishing, to computer viruses, microcomputer support, and strategic

planning. Typical queries relate to attribution policies, documentation, and software usage; one subscriber even asked the group what journals they find most relevant. Readers have responded to questions, offered expertise and experience, and helped fellow editors avoid pitfalls. To facilitate the exchange, all contributions include bylines with electronic mail addresses so subscribers can contact authors directly.

CCNEWS is open to anyone who has access to BITNET, either directly or via gateways from other networks. Subscribers include editors, writers, graphic artists, networking specialists, and a variety of computing facility managers and staff. Mary Peterson, from the University of New Hampshire, wrote, "I am not a campus newsletter editor, but I do assist with our computing newsletter, *On-Line*, and I find CCNEWS interesting, relevant, and helpful."

CCNEWS has also attracted international subscribers. A recent count totaled 22 individuals from Europe and Asia, and the number is growing steadily. Since hard-copy newsletters rarely find their way to foreign institutions, CCNEWS promises to be an effective medium of international information exchange.

ORIGINS

EDUCOM has been a leader in inter-university computer networking since the mid-1960s[1] and always tries to "practice what it preaches." EDUNET, with its online database of instructional resources, was an early example, soon followed by EFPM, a network-accessible financial modeling system popular in pre-spreadsheet days, and Mailnet, an inter-campus electronic mail system. Current projects include operating the Network Information Center for BITNET (under contract with BITNET, Inc.) and staffing the Networking and Telecommunications Task Force (NTTF), which is pursuing partnerships with government and industry to develop the national education and research network.[2]

When the EDUCOM Publications staff observed and experienced the "look and feel" of electronic publications, like *Info-Mac, NetMonth*, and newsletters from the Association for Institutional Research and the Society for College and University Planning,[3] we were eager to get more actively involved. In parallel, we observed the marked similarities among the scores of campus computing newsletters, and the concept of CCNEWS began to emerge: an electronic newsletter combined with an articles archive. After approval of the concept by the EDUCOM Board of Trustees, CCNEWS was announced at the ACM SIGUCCS Computer Center Management Symposium in March, 1988, and the subscription drive began.

PROSPECTS FOR THE FUTURE

Developments in network communications — both technical and political — foreshadow the time when electronic publishing and information delivery will compete with or even supersede journals, newspapers, magazines, books — and newsletters. Sophisticated databases as nodes on a network, bibliographic utilities with search protocols that operate through networks, and artificial intelligence systems will eventually become commonplace. Commercial and industrial networks and services could merge with those supporting higher education, resulting in rich resources available at low cost

to scholars and students.

In the meantime, the national network movement in higher education is growing quickly. Paralleling the dramatic growth in the national networks like BITNET and NSFNET are the extensive intra-campus networks being planned and implemented.[4] Universities are spending millions to connect faculty and staff offices to labs, libraries, computing centers, and (in some cases) dormitories. Such developments are, of course, extremely propitious for services like CCNEWS.

The number of campuses with easy access to CCNEWS and the number of connected individuals on these campuses naturally increase the base of both potential contributors and potential readers of this service. As is typical of most groups, early experience with CCNEWS suggests that most subscribers are passive recipients rather than active contributors, but growth in subscribers should result in more contributions, which should add interest — and more subscribers. An alternative source could be syndicated writers, perhaps specialists, who might find such a large audience (both direct subscribers and readers of subscribers' publications) worth their efforts.

For those institutions that are slow to connect to the national and regional networks, EDUCOM encourages nearby institutions to offer guest accounts. Not only will this provide broader access to network services like CCNEWS, but also such an introduction, if successful, could lead the institution to join the network at a later date.

Growth is not always easy to manage, of course. In the case of CCNEWS, the current articles indexing scheme would probably not support 500 articles; it certainly would break down before 5,000. In addition, new subscribers would not necessarily have interests and needs matching the earler ones, perhaps leading to special editions for liberal arts or community colleges. Alternatively, divisions might emerge focused on desktop publishing and/or electronic publishing, independent of campus computing content.

Assuming that both the contributions and indexing problems can be solved, there would be no reason to restrict archive access to campus computing staff. CCNEWS or its successor(s) could become repositories of information for anyone on campuses interested in its topics. This notion dovetails with developments on some campuses, like Cornell's CUINFO, which offer extensive databases of computing and non-computing information to the community.

For the immediate future, however, higher education publications and information resource professionals interested in such services will need to wrestle with such vexing questions as:

- What intellectual property rights apply to network communications?
- Are property rights the same as software and print?
- How should graphics and formatted text be distributed for printing?
- How should electronic newsletters be designed for either online viewing or printing?
- How will hypertext, hypermedia, CD-ROM, and distributed databases effect distribution of information?
- Is an electronic mail address directory feasible?

CONCLUSION

Michigan State University's Marilyn Everingham finds that, "CCNEWS pulls together a peer group from which information and help can be drawn. Questions can be posed with a good chance of getting an answer from someone who's actually experienced the same problem. Nothing speaks quite as clearly as the voice of experience." Mary Peterson, from the University of New Hampshire, comments that, "CCNEWS is the best list I've subscribed to yet. I'd like to see even more discussions on writing for campus computing organizations including information on books, conferences, and other resources for effective writing and reporting." Tapping into the audience most capable of helping them improve their skills is an invaluable asset to many subscribers. According to Claudia Lynch at the University of North Texas, "I see CCNEWS serving as a window to the world of other computing center newsletter editors. I can console myself, knowing that I am not the only one who suffers from reluctant staff contributors, etc."

Although CCNEWS is not a startling technical innovation, the potential of a worldwide network of campus computing newsletter editors and an easily accessible archive of articles and other materials is exciting. Charity Cicardo at the University of Denver, summed up her experience with CCNEWS this way: "I feel that new doors have been opened. In the future I could be publishing only electronic publications. With exposure to CCNEWS, at least I won't be taken by surprise when it occurs." We agree.

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2. "National Net'88 Double Issue: Public and Private Initiatives to Create a National Education and Research Network," *EDUCOM Bulletin* Vol. 23, No. 2/3, Summer/Fall, 1988. (For single copy, contact 609 520-3366 or send electronic mail to PUBS@EDUCOM.)

3. John A. Dunn and John Muffo. "Exhiliration and Exasperation: An Open Letter to Everyone Who Thinks His Professional Association Should Communicate Electronically," *EDUCOM Bulletin* Vol. 23, No. 2/3, Summer/Fall, 1988, pp. 88-92. (Also available online in the CCNEWS Articles Archive.)

4. Carolyn Arms (ed.) *Campus Networking Strategies.* Bedford, MA: Digital Press, 1988. ($20 for EDUCOM members; contact 609 520-3366 or send mail to PUBS@EDUCOM.)

For more information on CCNEWS contact the authors at the address previously listed, call 609 520-3366; or send fax mail to 609 520-3975. Electronic mail can be sent to CCNEWS@EDUCOM.

Appendex 1

Welcome to CCNEWS

You are responsible for editing and producing a newsletter for campus computing and networking users. Your best consultants are too busy doing seminars and answering the hot line to write. You are intrigued by the power of the latest desktop publishing and graphics tools. You wonder about the best mix of newsletters, manuals, mini-memos, online help, and bulletin boards to serve a growing and increasingly heterogeneously user community.

You subscribe to several peer institutions' newsletters, looking for ideas on content, format, new approaches. Many cover the same territory, but occasionally someone does it brilliantly—with insight, style, humor. If only the best pieces were in a database on the network, keyword-searchable, available fo down-loading—with attribution, of course. Short of that, if only you could communicate easily with other editors, sharing queries, answers, hints, gripes, your favorite articles. CCNEWS is the forum you seek. Our hope is that hundreds of editors of newsletters and other information sources in the U.S. and abroad will participate in an online exchange of information and opinion that can:

- make us more effective
- improve our campus information services
- be more fun than ghost-writing the "From the Director" column.

—From CCNEWS Vol. 1, No. 1, April 8, 1988

To subscribe to CCNEWS, send an interactive message or electronic mail to LISTSERV@BITNIC containing the following text: Subscribe CCNEWS FirstName LastName - Institution

Appendix 2

++
CCNEWS Articles Index
++

The files below contain articles from campus computing newsletters, EDUCOM publications, and other sources. They are freely available for research and reprinting, with attribution, in newsletters and elsewhere.

Anyone with access to BITNET (directly or indirectly) can retrieve full text by sending the following command to LISTSERV@BITNIC, either as an interactive message or in the first line of a mail message:

GET Filename Filetype

(where Filename is related to the subject and Filetype is usually constructed from the last name and first initial of the contributor).

Also shown in the index are the network address of the contributor (Author@Node), subject key words, the issue of CCNEWS containing the article abstract, the original date of publication, and the file size (in lines).

Back issues of CCNEWS are also available from LISTSERV@BITNIC. Send an interactive message or mail message containing:

SEND CCNEWS XX-000yy

where XX is the year (88 or 89), and yy is the issue numb.

Contributions are encouraged to CCNEWS@BITNIC. Please send straight ASCII text, 75 character line, block left, ragged right, one space after periods, and doule spaced between paragraphs. For articles, please include the author(s), institution(s), e-mail address(es), and full citation (publication name, volume, number, date, pages, etc.).

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Appendix 2 (cont'd)

Filename	Filetype	Userid	Node	Subject	Issue	Date	Lines
ARTICLES	INDEX	CCNEWS	EDUCOM	This file			
ASCII	ZABLOS_P	USERJON	UBCMTSG	A Stroll Around ASCII	88:18	08/88	246
AWARDS88	ARTICLE	ESI	EDUCOM	Enhancing Learning: 1988 EDUCOM/NCRIPTAL Higher Education Software Awards	89:01	12/88	722
AWARDS88	EDU_NCRI	ESI	EDUCOM	Winners of the 1988 EDUCOM/NCRIPTAL Higher Education Software Awards	88:20		561
BACKUP	EVERIN_M	11600ME	MSU	Using Backup and Restore: Essential DOS Commands	88:12	01/88	415
BACKUP	HOLLAN_P	PAT	CRNLGSM	Back UP to the Future	88:22		50
BASICS	LEE_G	ISBalkits	UCDAVIS	From Arcane ASCII to the Printed Page—Computer Basics*	88:29		103
BBOARD	BARBER_S	AC10	NTSUVAX	New Bulletin Board Service	88:13	04/88	111
BBOARD	EVERIN_M	11600ME	MSU	Bulletin Boards	88:9	04/88	116
BIBLIO	SNYDER_M	SNYDER	UBACS	DTP Bibliography	88:4	01/88	43
BRAIN	McPART_T	PAM	GUVAX	Combatting the Brain: A Computer Virus	88:10		304
BYTING	ROSS_F	USERARQH	RPITSMTS	They're BYTING Today—Fish Catalog On-Line*	88:31		67
EVENTS	CALENDAR	CCNEWS	EDUCOM	Calendar of Events	88:14		
CCNEWS	NAMEI[illegible]	GE0110	SIUCVMB	Sorted by Last Name	88:29	11/88	647
CCNEWS	SIGUCCS	CCNEWS	EDUCOM	CCNEWS: An Online Forum for Newsletter Editors	88:16		379
CHANGE	HARTMA_A	TACVAGH	TCSVM	Plus ca Change	88:22	09/88	158

Appendix 2 (cont'd)

Filename	Filetype	Userid	Node	Subject	Issue	Date	Lines
CONFER	EVERIN_M	11600ME	MSU	An Introduction to Conferencing	88:8	04/88	123
CONVER	GILBERT	GILBERT	EDUCOM	The Conversion Experience	88:15	05/88	122
DATALOSS	HARTMA_A	TACVAGH	TCSVM	Understanding Data Loss	88:22	07/88	68
DIGITAL	CARR_D	NETOPRDC	NCSUVM	Bring Your Macintosh to Life with Digital Sound	88:19	08/88	263
DISKBACK	EVERIN_M	11600ME	MSU	Disk Backup Strategies	88:12	01/88	509
DOS	EVERIN_M	11600ME	MSU	Setting Up and Using Dos On Your Hard Disk	88:11	02/88	216
DIRS	EVERIN_M	11600ME	MSU	Directories and Subdirectories	88:11	02/88	302
DTP1	HOLLOW_J	HOLLOWAY	IUBACS	Desktop Publishing: An Introduction	88:4	03/88	136
DTP	HARTMAN	TACVAGH	TCSVM	Ay, There's the Rub	88:18	03/88	146
DTP	LYNCH_C	AS04	NTSUVM1	Choosing a Desktop Publishing System	88:13	04/88	329
EDUCOM89	BROCHURE	CONF89	EDUCOM	EDUCOM89 Conference Brochure			
EMAIL	EVERIN_M	11600ME	MSU	What is E-Mail?	88:8	04/88	107
EMAIL	WALTERS	MWALTERS	UWYO	Electronic Mail: Doorway to the World	88:14	07/88	83
EMAILALT	EVERIN_M	11600ME	MSU	E-Mail Alternatives: Telex and Teletex	88:8	04/88	79
EMAILY_P	ANDER_A	ANDERSON	UCLAMVS	Ms. Emaily Post: The Etiquette of Electronic Mail	88:10	03/88	209
ENEWS	DUNN_J	SCUP	TUFTS	Exhileration and Experation: An Open Letter to Everyone Who Thinks His Association Should Have an Electronic Newsletter	88:10	06/88	339
ERGO	BALKITS	ISBalkits	UCDAVIS	Human Factors in Workstation Design	88:18	08/88	48

Appendix 3

CCNEWS NATIONAL EVENTS CALENDAR

This National Events Calendar contains information about conferences, seminars, and workshops related to information technology in higher education.

Updated weekly, this listing is a service of EDUCOM's CCNEWS: An Electronic Forum for Campus Computing Newsletter Editors on BITNET. For information on CCNEWS, or to contribute material to the National Events Calendar, send electronic mail via BITNET to: CCNEWS@BITNIC

Feb 13-14	89	LaST Frontier Computer Conference Tempe, AZ	 contact: 1-602-965-2124
Feb 21-24	89	1989 ACM Computer Science Conference Louiseville, KY	 contact: 1-212-869-7440
Feb 26-Mar 3	89	SHARE 72 Los Angeles, CA	 contact: 1-312-644-6610
Mar 15-17	89	ACM SIGUCCS Computer Center Mgmt Symposium St. Louis, MO	 contact: 7ETPPCC@CALSTATE
Mar 30-31	89	Western Educational Computing Workshops Santa Cruz	 contact: 1-415-338-1212
Apr 3-5	89	National Net'89 Conf Washington, DC	 contact: NET89@EDUCOM
Apr 12-14	89	Conference of University Administrators Univ. of Sussex, Eng.	 contact: + 44 273 678384
Apr 13-16	89	5th Annual Inter'l Conference on Computerization of Medical Records Anaheim, CA	 contact: 1-617-964-3923
pr 21-22	89	Small College Computing Symposium Eau Claire, WI	 contact: DRALEIGH@UWEC
Apr 30-May 3	89	AIR (Association for Institutional Research) Baltimore, MD	 contact: 1-904-644-4470
May 14-17	89	CUMREC'89, College & University Computer Users Conf. Boston, MA	 contact: Phil Philips, MIT
May 14-17	89	SHARE 72.5 Interim Meeting Denver, CO	 contact: 1-312-644-6610
May 1'	89	MUG'89 Tools Workshop Chattanooga, TN	 contact: MUG89@UTCVM
May 17-19	89	MUG'89 Conference Chattanooga, TN	 contact: MUG89@UTCVM

Appendix 3 (cont'd)

CCNEWS NATIONAL EVENTS CALENDAR

May 20- 23	89	3rd International Conference & Exhibition on Children in the Information Age Sofia, Bulgaria	contact: write to: bl 25A, Acad G Bonchev Str Sofia 1113 (Tel) 7131 ext. 620 (Telex) 22056 KZIT BG
May 21- 24	89	Software Publishers Association Conference San Diego, CA	contact: 1-202-452-1600
May 21- 24	89	American Society for Information Science Mid-Year Meeting (ASIS) San Diego, CA	contact: IIN4CLB@UCLAMVS
May 29- 31	89	EARN'89 (3rd International Conference on Networking and User Support) Heraklion, Crete, Greece	contact: LISTSERV@BITNIC file EARN89 Program
Jun 20- 22	89	National Educational Computing Conference Boston, MA	contact: 1-617-868-9600
Jul 9- 11	89	NACUBO Philadelphia, PA	contact: 1-609-343-5100
Jul 19- 22	89	First AIR Breckenridge Institute. Information: The Critical Resource For Strategic Management Breckenridge, CO	contact: IRDJT@UKANVM
Jul 23- 26	89	Society for College and University Planning Conference Denver, CO	contact: USERTD8Q@UMICHUM
Jul 23- 28	89	Sixth International Meeting University Administrators College Park, MD	contact: John Bielec,
Aug 4- 9	89	Seminar on Academic Computing Snowmass, CO	contact: DJBIRD@ORSTATE
Aug 20- 25	89	SHARE 73 Orlando, FL	contact: 1-312-644-6610
Oct 16- 19	89	EDUCOM'89 Conf Ann Arbor, MI	contact: CONF89@EDUCOM
Nov 16- 17	89	Western Educational Computing Conference Burlingame, CA	contact: 1-415-338 1212
Nov 28- Dec 1	89	CAUSE89 San Diego, CA	contact: CAUSE@COLORADO

Figure 4

LISTSERV

Have you ever communicated with 100, 200, or 400 people at once, even though they were dispersed over great distances? Have you ever had the opportunity to correspond electronically with hundreds of peers on topics of common interest? Have you ever asked a question and received responses from a dozen people around the country and around the world that same afternoon?

This is just what is happening for thousands of scholars, researchers, administrators (and often students), connected to academic computer networks supporting the "mailing list" software called LISTSERV. Generally described, LISTSERV takes an electronic mail message sent to a "list" and distributes it to all of the "subscribers" on that list. Each subscriber can send from his or her own electronic mail system to lists located anywhere on the network. LISTSERV also maintains archives of past messages, which can be retrieved easily.

Currently, over 420 unique mailing lists operate using LISTSERV at sites connected to the BITNET academic computer network, which consists of 380 institutions and over 1500 nodes (separate host computers) in the U.S., Latin America, and Asia. Some of these are "open" (not restricted in access or distribution), some are "edited" (collected and sent out at specified intervals), and others combine these two. List topics range from the very technical (UNIX-EMACS), to the very urgent (AIDSNEWS), and the humorous (Nutworks, a comic magazine). Many lists also cross the Atlantic (to EARN, the European Academic Research Network), and the northern U.S. border (to NetNorth, the Canadian academic network).

For individuals at institutions already connected to BITNET, LISTSERV list subscriptions are free with an account that has access to national networks. For institutions to become members of BITNET, the basic costs include an insitutional fee, modems, leased-line connections, and an electronic mail system to connect to the network.

For more information about LISTSERV lists or BITNET, individuals should contact their local BITNET institutional representative. For more information about BITNET Membership, contact the BITNET Network Information Center at EDUCOM, P.O. Box 364, 777 Alexander Road, Princeton, New Jersey, 08540; 609 520-3377. If you're already on BITNET and want to see a "list of lists", send the command LIST GLOBAL to LISTSERV@BITNIC.

—Adapted from "LISTSERV Software Connects Thousands via Electronic Mail," *EDUCOM Bulletin* Vol. 23, No. 2/3, Summer/Fall, 1988, p. 89. ☐

RIVERSIDE COMMUNITY COLLEGE DISTRICT

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4800 MAGNOLIA AVENUE / RIVERSIDE, CALIFORNIA 92506-1299 / (714) 684-3240

Innovative Approaches to Integrating New Technologies with Matriculation Efforts Using Smart Card Technology

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For several years, the California Community Colleges have been working to further develop and enhance matriculation procedures. As part of this effort, supplemental monies have been made available to support innovative approaches to integrating new technologies with matriculation efforts. Riverside Community College, in association with Systems and Computer Technology, E-Squared Technologies and Pacific Bell, will incorporate the "smart card" with PCs, advanced "intelligent" telephones and the College's mainframe based student information system. By loading onto the smart card a student's academic history we can use the PC to access program and transfer data. The student, working with a counsellor, will be able to review progress toward specific graduation or transfer goals. The student may also obtain specific course by course and college by college articulation information enabling him/her to better meet education goals.

THE PROJECT

Riverside Community College (RCC) has proposed an innovative approach to assist with matriculation in the California Community Colleges. The approach provides a simple and cost effective mechanism to support the following activities on a distributed and transferable basis:

* Provide students, counselors, tutors and others, a planning and analysis tool with which to provide information on progress towards a student's educational goal. This tool allows for comparisons of student coursework against degree and certificate requirements (degree audit) and articulation agreements with neighboring colleges and universities he or she may wish to attend.

* Provide a college or university, to which a student may aspire, the capability of easily accessing student, academic data which can be used for counseling and academic planning.

* Allow assessment, counseling and academic planning to be provided remotely, on multiple campuses or other locations with efficient access to the student's academic history and degree, certificate or transfer requirements.

The system being developed incorporates the use of smart cards, intelligent telephones, pers nal computers all in conjunction with the college's mainframe computer system. Smart cards are very small microcomputers packaged within credit card sized plastic cards. They provide a highly portable, efficient, and secure device upon which information can be carried. Such information as the student's academic history and educational plan can be stored electronically and transmitted between institutions and computers.

RCC, in conjunction with Systems & Computer Technology (SCT) E-Squared Technology (E-Square), Pacific Bell Telephone Company (Pac Bell) and the California Community College Chancellor's Office, will implement a demonstration project using this equipment in conjunction with a degree audit and articulation system, PC based, called "Project ASSIST." These smart student IDs will interact with assessment, counseling and planning applications being processed on independent personal computers. This approach makes the system extremely portable within a given college as well as exportable to other

institutions. Where multiple institutions have this approach in place, the data and tools required for appropriate academic planning for a student can be made available to all locations. The approach is practical, simple and cost effective. There is no need to invest great sums of money in complex data bases and real time networks. Nor is there need to maintain duplicate data bases between institutions. The official student's data will continue to be maintained by the college's central computing resource. The smart card will simply carry a copy of the appropriate data as of the most recent date and time the card interacted on-line with the central machine.

The experience of RCC with this project will be objectively evaluated and the results will be available for sharing with other colleges and districts. In this way the project will provide others information on a simple, innovative and cost effective approach to support matriculation.

OPERATION

Students will be issued smart cards that are capable of storing and carrying a variety of information about the student. Students will use these smart cards to download from the mainframe, via smart telephones, appropriate academic data from the official records. To accomplish this, a student will insert his or her card into a smart telephone, select the appropriate menu option, enter his or her student identification and personal security code and have the system load current academic history data onto the card. The student may update his card (i.e. repeat the process) with a copy of his official record as often as he wishes or is deemed necessary and appropriate.

Once the card contains appropriate academic data, it will be used in conjunction with Project ASSIST running on a personal computer. This application provides or assessment of the student's record relative to his or her goals and evaluates those goals against stated degree and transfer requirements. For example, the student could obtain the following information and analysis:

* What courses have been completed that will transfer to neighboring institutions?
* What courses will be needed to complete graduation requirements for specific certificates or degrees?
* What other options are available?

The student can gain the above information for specific schools and majors as long as the institution has provided the

data in the form of articulation agreements. We anticipate that the systems developed from this project will enhance articulation efforts by allowing information to be transferred between cooperating schools in a much more concise manner and format.

This interactive process will be done at a personal computer with the smart card inserted in an associated r' ler/writer. The output would be to a hard copy printer which the student and counselor could review. It is also envisioned that the system will allow the student to capture on the card his or her proposed academic plan resulting from the session. This will allow additional counselling sessions to be held with much more current data.

Obviously, the system is usable by the student alone, or in consultation with tutors, counselors, assessment staff and others. The system, without the card, can be used as a planning and recruitment tool for high school seniors.

When the student takes the card, and its contained information, to a participating institution, a much more detailed discussion can take place regarding available programs based on actual completed coursework. Thus, this simple approach provides information for matriculation to be available and useful when and where it is needed.

Presenter Information

Presentor 1: David J. Bell
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Biographical Information: David graduated from Central High School, Phildelphia, Pa., with a Bachelor of Arts degree and from Drexel University, Philadelphia, with a Bachelor of Science degree in Commerce and Engineering Sciences. Prior to joining RCC, David worked for Systems and Computer Technology, Deloitte, Haskins and Sells and International Business Machines (IBM).

Presentor 2: George Bjarke
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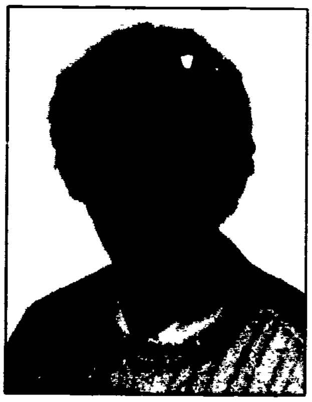
Biographical Information: George has been employed by Systems and Computer Technology Corporation (SCT) for the last nine years. He has held a variety of positions, all involved with the development of information systems at colleges and universities. Prior to joining SCT, he was the Director of Admissions at Pepperdine University. He holds both a Bachelors and Masters degree in Psychology, with an emphasis in school psychology and counseling.

Track VII
Hardware/Software/Networking Strategies



Coordinator:
Gerry Weitz
Stanford University

Policy planning, implementation, and organization affect strategies for hardware, software, and networking. How are specific strategies developed and implemented within an overall strategic plan for information systems?

Papers in this track present case studies and discuss institutional experiences in developing such strategies, whether starting from ground zero, describing a transition, or retrofitting an earlier system.

William Branch, University of Central Florida

Barbara B. Wolfe, CICNet

CAUSE 88

Technological Synergies are No Accident!!

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ABSTRACT

Managing the integration of technologies requires maximizing the natural synergies between technologies and the organization. These synergies are no accident. They must be carefully developed in concert with institutional priorities, with buy-in from key constituents, with support deep within the organization. These can only happen through effective planning and management of information resources. Realizing these synergies is one benefit of an IRM approach.

Cal State L.A. is in the process of implementing an integrated information infrastructure including a new digital telecommunications system ($4 million purchase/cut-over August 1988), a new administrative computing system (IBM/IA installed Fall 1988), and an academic technology system (access labs, faculty workstations, a broad array of software and networked output devices). This paper explores the interrelationships between organizational structures, the introduction of technology, and the development of synergies.

Technological Synergies are No Accident!!

Introduction

A *synergism* is defined as "a cooperative action of discrete agencies such that the total effect is greater than the sum of the effects taken independently." [1]

What are technological synergies? They are events that happen in an organization very naturally. They capture the energy of the people in the organization. They are instances where the investment (human, financial, and technological) is the genesis for an exciting outcome--where, for example, a faculty member can fulfill a dream to create a center of excellence, to grow beyond his or her current bounds and bring the institution, its students, and other faculty along with the vision.

How do they happen? Not just by accident! They happen where information is seen as a vital institutional resource. They don't happen where layers of bureaucracy, middle managers, and overseers filter, sift, and sterilize ideas to fit a pre-ordained chalice. They happen where the energy of the individual with a vision can be recognized, nurtured, and assisted to develop the vision. They happen in an organization that welcomes that vision into the information culture and draws creatively on its collective resources to realize it. They happen where there is organizational sensitivity and expertise for treating information content and technology as a strategic resource.

Creating this environment is what a true information resources management approach is all about. Such an approach changes the strategic orientation of the organization. It empowers the people in that organization with the flexibility to act on intuition, to exercise judgment, to nurture original thought, and to translate that thought into reality within the basic bounds of the organizational mission. It creates an organization that tests its mission against realities, seeks challenges and opportunities, explores new methodologies, and views new horizons. The organization becomes less concerned with the lockstep of authority and more on the quality of each individual's action, stressing accountability. It is an organization that recognizes that the individual is the center of creativity but the organization is the primordial soup that brings the creative spark to life. The organization provides tools, expertise, and resources.

What is an information resources management approach? First, it goes far beyond the management of technology. It requires managing information as a strategic resource. In order to do this, there must be a focus on both the information technology and the information content of the organization, and a formal linkage between the institutional strategic vision and the information resources management program.

Second, it has certain characteristics where (1) the information resource management concept is defined in the context of the institution, (2) there is a governance structure for the management of information resources, (3) there is a desire to understand and articulate an appropriate vision for information resources, (4) there is a commitment to translate that vision into a unique design for the information architecture of the institution, and (5) there are appropriate technology policies and standards to allow the desired environment to be realized. [2]

California State University, Los Angeles undertook the creation of an IRM organization with such characteristics. The vision for IRM originated with the President, and was sharply focused on three strategic goals: to manage information technology more effectively, to maximize University investments in information technology, and to recognize that the use of information technologies for instruction, research, and in the management of the University is a necessary condition for institutional advancement. In 1983, he appointed a Presidential Blue Ribbon Task Force to make recommendations on how the University should go about accomplishing these goals. In February of 1984, the Task Force recommended taking an IRM approach. The new organization was fashioned out of existing units combining computing, telecommunications, media, mail, and reprographics and was brought to life in July 1985. [3]

Prior to establishing the IRM program, Cal State L.A. faced a host of problems many other MIS organizations face. Such problems included the lack of systems integration, failure to adequately satisfy user needs, users being estranged from the Data Center, systems not being synchronized with

institutional objectives, inadequately documented systems, the frustration felt from systems development always being in maintenance mode (where "firefighting" is the norm), and lack of senior management control over the systems development process. Like many other organizations these problems led to strong end-user demands for change.[4]

The desire for change has resulted in strong support for the IRM approach. To date, the support is broadbased, encompassing the executive officers, academic leadership, and mid-level administrators. The commitment involved the reallocation of staff and budget; participation in IRM governance, task groups, and project teams; and acceptance of shared responsibility for the development of information resources.

As with any new development, the building of an IRM program at Cal State L.A. was bound by certain constraints. Some reflected the nature of a large state university within a multi-campus system, while others were very specific to the campus. Examples are having a nontraditional student body with unique needs, and having strong faculty involvement in planning and administration. Constraining realities include the Governor's cap on the number of State employees, the mandate to serve a specific geographic area, a primary mission as a teaching institution, and a static State budget for administrative computing. Although opportunities existed such as State funding for replacing the telecommunications switch, overall resources normally available through historical channels were inadequate.

Resources are provided through a wide variety of mechanisms with varying degrees of flexibility for usage. For example, some State funds are calculated and distributed by formula but allow flexibility at the campus level when expended. Other funds are allocated by line item with no choice or flexibility. Certain monies are allocated on a one-time basis with no commitment for continuing support. There are funds allocated directly to IRM or other segments of the University and other funds that require a proposal or individual justifications in order to acquire them.

In establishing the IRM program, the University was faced with the problem of determining how to strategically utilize these diverse funds . The concept of leveraging was a natural conclusion. Leveraging meant recognizing that no one source of money was necessarily big enough to realize the strategic vision. A process of matching funding components with project components was implemented along three general guidelines: (1) projects must be built on realistic estimates, (2) projects must have deep involvement and buy-in from other segments of the institution, and (3) there should be open reporting of expenditures back to those segments.

On large projects where resources were still insufficient, the campus undertook more creative solutions such as building relationships with vendors for joint development. Major efforts were launched including partnerships with IBM and Information Associates for administrative computing, with AT&T for academic systems development, and with Centel for campuswide telecommunications networking.

In like manner, human resource needs required creative solutions and a sort of leveraging. As a new organization grows and develops, some vacant positions are critical to recruiting external expertise. Beyond that, ways must be found to maximize existing human resources. One way is careful selection of key individuals for involvement in projects. Once selected, the key is giving those people the power to impact the implementation, while providing them with training and advice so that recommendations are sound. Another approach is to combine training and professional development funds and to order them according to institutional priorities. Requiring those who attend professional development or training to return to campus to become the trainers stretches both the value and impact of scarce dollars. In any dynamic information organization, there will always be a need for external expertise. The trick is to make sure that when the expert leaves, the expertise does not. Leveraging investments in human capital in these ways expands opportunities by increasing individual potential; this in turn increases organizational flexibility, improves morale, and provides powerful motivation for change.

Communication is a critical component of maximizing the organization's human capital and effectively utilizing fiscal and physical resources. Developing adequate formal channels, keeping them open and freely flowing, and encouraging the necessary informal networking is a major undertaking. One key to pulling all this together is planning.

Planning Dynamics and Evolution

> Instability characterizes information systems strategic planning. During the past 20 years, alterations have been so frequent that planning has sometimes seemed faddish, yet research shows that the emergence of key planning ideas generally has coincided with advances in information technology. Planning may be viewed as a rational response to the evolving information systems environment.[5]

For best results, the strategic direction of an information management program must not only be aligned with but supportive of the strategic direction of the institution. Herein lies a problem: if the organization does not have a well-articulated strategic vision mapped out; can information resources planning still take place? The answer is yes, but care must be taken to ensure the match. At Cal State L.A., strategic planning for information resources predated the development of the university process. Great care was taken to ensure that the development of the IRM program was made within the context of the verbally articulated institutional strategic vision. Recognizing that, when implemented, strategic planning for the University would necessarily be evolutionary rather than revolutionary was also important. Further, the strategic planning process needs to be fused with the management process. The plan should be built with wide user consultation, and the goals and objectives should reach deep into the heart of the organization.

Three different forces drive strategic planning for IRM for Cal State L.A. The first force, the *Campus Information Resources Plan* (CIRP), mandated by the CSU system, formed the basis for the system budget request. The second force, the need to build and shape a newly-formed campus IRM organization, was required to map the transition of diverse units into a functional IRM program. The third force, the institution-wide strategic planning process, came along later but designates IRM as one of ten areas of tactical importance to the entire campus.

The first force, the CIRP process, requires each of the CSU's 19 campuses to develop an individual institutional plan which is then compiled into a system plan which drives information technology budget requests to the State. Started by The CSU in 1985, its existence provided a rather detailed, organized methodology as a foundation on which to build the initial IRM plan.

Second, as a new organization to Cal State L.A., the need to shape amorphous units into an information organization was a demanding one. There was a lack of understanding as to what an IRM organization was about. There were a number of turf issues. A formal model was identified and utilized to provide a sound structure for the formulation of the *IRM Strategic Plan*. The generic model, originally developed for higher education, was adapted to IRM. It called for an analysis of strengths, weaknesses, and environmental trends to feed a matching process relating external opportunities and constraints to internal strengths and values. The matching provided the basis for development of an extended mission statement, the delineation of clientele, the development of goals and objectives, and the establishment of an appropriate program/service mix. These parameters then formed the basis for guiding the development of individual unit plans.[6]

The last major force to take shape, but perhaps the most important, was the development of a campus strategic planning process. The CIO at Cal State L.A. plays a key coordination role in the process for the President. The campus through a deliberate, consultative process determined that the adoption of a formal planning model would best serve its needs. Again, the basic methodology selected was the "Shirley model" which was then adapted to Cal State L.A.[7]

These diverse forces have evolved over time so that all the separate planning requirements for IRM have been accommodated in one meaningful process. They have culminated in a results-oriented "living" plan which has become an effective management tool. In 1985/86, the IRM program was new, setting forth 35 stated objectives and completing 94% of them. As the process matured, the number of stated objectives grew and, in 1986/87, 83% of the 81 IRM major objectives were completed. During the 1987/88 fiscal year, stated objectives grew to 117, with a completion rate of 90%.

One key to successful strategic planning and management is the ongoing use of evaluation. An evaluation process is most effective when it is developed as an integral component of the program. As a strategic tool, the evaluation process can monitor user satisfaction, track unanticipated accomplishments, identify both the most and least effective employees, and help identify problems with

process, procedures, and policy. At Cal State L.A., user satisfaction is solicited and evaluated monthly. The results of this ongoing evaluation are acted upon by each responsible unit head and results are reported back to the user community regularly. Annual evaluation is done of all information resources management accomplishments including those anticipated and those that were unanticipated but resulted from strategic opportunities arising during the year. During the last fiscal year thirty-one accomplishments, that were not part of the original work plan were documented. Certain of the unanticipated outcomes were classic synergies such as the center of excellence mentioned in the **Introduction**. Formal evaluations of IRM unit personnel are integral to aligning personal performance with institutional objectives. At Cal State L.A. all managers annually evaluate each other against a predetermined and agreed-upon set of criteria. IRM units and managers are evaluated against their individual work plans and their contribution to completing IRM objectives. Each supervisor discusses individual evaluations, noting strengths and weaknesses and sets forth improvement strategies for the coming year's personal agenda.

The essence of planning is creating an environment in which the organization outlines where it is going and prioritizes the resources, including the budget and human capital it needs to get there. Inherent in this approach is the ability to recognize opportunities along the way and to capitalize upon them.

Background and Assumptions

As mentioned in the introduction to this paper, the second point in defining an IRM approach was a list of several characteristics that warrant further explanation. The first is to define the IRM concept in the context of Cal State L.A. In October 1988, the campus published its first *Strategic Plan for the California State University, Los Angeles* which set forth the institutional context for IRM. "The University ... supports the use of new technologies to enhance and enrich the instructional process and prepares students to understand cultural diversity and to serve the changing needs of a global society." [8] The strategic plan goes on to detail a more specific role of technology with the goal, "To advance the teaching, research, and public service missions of the University through the application of state-of-the-art technology and information management, thus providing a model for comprehensive universities." [9]

While information resources management can be loosely defined as the management of the resources concerned with supporting and servicing information, a much more specific mission for IRM was fashioned. One of the primary management goals is to integrate planning and management systems. The implementation of the IRM program is based on four tenets: (1) planning for information technologies should be directed by the fundamental values and purposes of Cal State L.A.; (2) the use of technologies for instruction, research, and in the management of the University is a necessary condition for advancing to a higher level of excellence; (3) the attraction and adoption of technology should strengthen the instructional, research, and management functions and promote the intellectual and personal interaction of faculty, students, staff, and administrators; and (4) a commitment to service must be one of the cornerstones of the IRM organization and therefore the *Strategic Plan for Information Resources Management*. [10]

The second characteristic is to establish governance for the management of information resources. IRM has developed a participative organizational decision structure composed of four interrelated committees. The **Information Resources Management Steering Committee** assumes a fundamental role in providing representative, campuswide advice on IRM strategic planning, policy, procedures, and standards at Cal State L.A. The **Faculty Information Resources Advisory Committee** is charged with providing advice and guidance in the development of information technologies in support of curricular activities. The **Information Resources Management Administrative Advisory Committee** provides advice on all administrative projects. The **Information Resources Management Advisory Committee** (IRMAC), an internal IRM committee, is composed of most senior managers. This committee structure, employing Likert linking pin theory, has been used and fine-tuned over a period of years and is designed to facilitate formal and informal communications. [11]

The third characteristic is to understand and articulate the desired target environment for information resources. The goal at Cal State L.A., formally stated in the *Strategic Plan for Information Resources Management*, is to establish an environment, by the early 1990s, that will place the user, student, faculty member, or staff member at the center of his or her information resources universe. A networked workstation will provide individual computing and access to more powerful layers of computing capability, data, and summary information--the level needed to enable the individual to perform the

specified academic or administrative task for which the use of information technology was initially sought.[12]

To translate that vision into a unique design for the information architecture of the University is the fourth characteristic. The resultant information infrastructure includes a campuswide digital telecommunications system and backbone network, integrated administrative systems founded in a relational data base, and layered academic systems to support the instructional/research mission.

Today Cal State L.A. is in the process of implementing the integrated information infrastructure. At the heart of the new infrastructure is the new digital network. In November 1987, a contract was awarded to Centel Communications Systems for an SL-1 XT PBX, Infotron INX 4400 data switch, Proteon Pronet-10 fiber optic data network, Microvax 3600 system management computer, and Digital Sound Voice Server. Project implementation began in January, with installation in late August 1988.

The vision for administrative systems rested on an integrated relational data base environment. The new environment would include student records, financial systems, human resources management, and alumni development components. The modules would by tied together logically permitting the most effective use of technology in the management process. A new administrative system to achieve this vision is now under development. The first phase, a student records system, utilizes IBM hardware and Information Associates software. An IBM 4381 mainframe computer was installed in September 1987 to support Information Associates integrated Student Information System. The second phase, beginning in December 1988, will incorporate and enhance current SIS functionality in IBM's DB2 environment.

The academic technology system under development is in transition from a "closed systems model" for computer architecture to an "open systems model." This model permits logically configured sub-systems of each local system to be viewed and used as a network resource from across the whole environment. This new environment is being driven by the convergence of six technological developments: (1) dramatic increases in the power of desktop computers; (2) greatly increased capacities for mass storage; (3) new and more powerful multi-tasking and multi-user operating systems (i.e. OS2, UNIX); (4) icon-oriented graphic interfaces based on the needs of human intelligence; (5) common communications protocols (TCP/IP); and (6) the adoption of standard open systems utilities (NFS-Network File System and RFS-Remote File System).[13]

This open systems model will enable the academic computing planners to develop a technological environment in which the individual becomes the center of the system rather than the machine. Over the past three years Cal State L.A. has increased student access workstations by almost 500 percent, provided microcomputer-based workstations for about one-third of full-time faculty, wired every faculty office and many classrooms for network access, and introduced a number of new technologies.

The final characteristic is to establish appropriate technology policies and standards that would allow the desired environment for information resources to be realized. Significant progress has been made including campuswide procurement policies, networking protocols, maintenance agreements, etc. This area is rapidly changing and requires ongoing reassessment and fine-tuning.

Integrative Management Techniques

There is some debate developing in the literature as to the longevity of the information resources management approach. Much of the debate centers on the creation of a Chief Information Officer or CIO. It is important, therefore, to set forth some assumptions. First, having a position designated CIO does not necessarily imply the creation of an IRM environment. Second, it is the IRM environment that is the critical element. Third, it is difficult to imagine an information resources management organization being as effective as it might be without a policy level officer of the organization to spearhead it.[14]

There are several reasons for this. The approach envisioned is supportive of "institutional strategic goals" not self directed, self serving goals, imposed by a supreme technological monarch. Indeed, self directed technocracy would create a backlash of technological anarchy. Rather than being a despot, the CIO should be a leader who is a relationship builder, understands motivation, and knows how to

inspire people. A leader needs patience, regardless of the urgency of the task at hand, and must listen, negotiate, collaborate, and cultivate.[15]

There have been numerous references to the CIO as a "computing czar." Herein lies a source of confusion. If the CIO in an organization exhibits czar-like tendencies, then chances are very good that the institution does not have (nor is it likely to have) the kind of IRM approach the authors envision.[16]

These leadership qualities set a very different managerial tone which can be amply supported with integrative management techniques. These techniques are most effective when employing an administrative model that embraces the concepts that management primarily derives its authority from knowledge, skill, and achievement. Ideally, decision making--rather than being the sole prerogative of administration--is most effective when it occurs among people closest to a particular activity. A participative committee structure can be used to provide overall guidance for implementation of major projects and enhance communications and understanding of the IRM program. A matrix approach to problem solving can often be very effective. Planning that leads to goals and measurable objectives appropriately evaluated enhances credibility through accountability. Teamwork within the unit and with other organizational units is essential. The importance of role definition, a balance between organizational and individual needs, rewards tied to productive performance, and the necessity for personal integrity are recognized as elements integral to good administration. Conflict resolution must be addressed and can be enhanced by an "open door" policy and the use of ombudspersons.[17]

By using some of these techniques, the creation of a new and different organizational culture can be accomplished. A critical component of the new culture must be acceptance by the IRM organization that responsibility to its clientele is inherent. The idealized culture could be described as an environment where all individuals are treated with courtesy and respect, an atmosphere of professionalism is maintained, individuals accept the responsibility of contributing to the solution of problems, the organization provides equitable and consistent service at defined levels, the security and integrity of campus data bases are maintained, and observing sound fiscal procedures is standard operating procedure.

Lessons Learned from Initial Implementation

The most important element in the overall infrastructure strategy at Cal State L.A. is the timely installation of the campuswide network. This project has provided important examples of synergistic occurrences resulting from the mix of planning, organization, project management, and technology.

One example involves the acquisition of voice mail as a component of the telecommunications system. Three years ago when the RFP was being drafted and the focus was on priorities (assuming somewhat limited funding), voice mail was given a low priority by the senior administration. Not wanting to drop it from the RFP, the telecommunications procurement team included a baseline voice mail unit as a mandatory option. Due to a well-written cost justification and fortunate timing, funding for the project turned out to be more than anticipated, enabling the purchase of the mandatory options in the RFP. The fiscal dean in the largest school recognized how useful voice mail could be to his faculty and agreed to purchase additional disk space for the voice mail system. Given these occurrences, the President authorized usage of year-end savings to further augment the system, and over 600 voice mail boxes are now active with the expectation that the number of subscribers will soon double in size. Needless to say, it is one of the most popular and usable features of the new telecommunications network.

Project OASIS (Online Administrative Student Information System), the administrative systems joint development project involving three CSU campuses, IBM, and Information Associates provides another example.

The project requires as much cooperation and coordination between the three campuses as is possible. Initially, there was concern as to how feasible this might be given that the campuses are different in many ways, including their academic calendars and academic terms. Such differences naturally lead to needs and priorities that do not match, yet it was necessary to derive an overall implementation and training schedule. Policy, operational, and technical level task forces were established to address the resultant issues and to monitor the progress of implementation. Although not entirely without difficulties, the diversity of the campuses has proven to be beneficial in ways beyond initial perspectives.

Due to different campus priorities and academic terms, modules have been installed days or weeks apart on the three campuses. The task forces have found that these anomalies are helpful by providing stimulation and questioning during training, bringing about more cooperation since one campus can learn from what has just happened at another, and allowing "bugs" or misperceptions to be identified more quickly than would be possible with a single campus.

A final example of technological synergies comes from the academic area. The campus has had an excellent working relationship with AT&T over the past few years, which brought an opportunity to present a proposal to them. The Academic Technology Support (ATS) unit, which has campuswide responsibility for coordinating and leveraging academic projects, initially approached the Department of Mathematics and Computer Science to draft a proposal to AT&T. Noting that both this department and the Department of Economics and Statistics had National Sciences Foundation grants with some monies earmarked for advanced workstations, the ATS Director discussed with them the idea of pooling resources and developing an advanced technology laboratory. All agreed that it was worthwhile to pursue. An Engineering and Computer Sciences Enhancement Grant was submitted to and funded by The CSU Office of the Chancellor. Additional funds were secured from the Academic Affairs Planning and Resources office, IRM, and the School of Natural and Social Sciences. The AT&T proposal was funded and a new advanced technology lab with two AT&T 3B2/400 minicomputers, nine Sun advanced workstations, and about 80 AT&T 386 workstations all connected on an Ethernet LAN supporting AI, CASE, mathematics, economics/statistics, and operating systems applications came into being. For each department involved, the capabilities of this lab significantly exceeds anything that could have been possible by the single unit.

Summary

The ability of an organization to maximize synergistic occurrences requires a special environment--one where there is vision, where individuals are empowered by the organization, and where information content and technology are envisioned as a strategic resource. These qualities, which are characteristic of an IRM approach, are not created overnight. First, the strategic vision for IRM must be defined in the context of the institution where it is implemented. Second, technology goals must be aligned with university goals. Third, the vision must be reinforced with policy and procedures. Fourth, the various diverse units have to be molded and integrated into a new organizational culture, a culture where there is a focus on integrating individual and organizational objectives in an atmosphere of accountability and flexibility.

Strategic planning significantly helps in fully realizing a synergistic environment. An effective process provides a mechanism for public relations, is a forum for collecting and sharing information, serves to build consensus, and establishes organizational direction and control. The public relations function builds external awareness. By providing a forum for information sharing and analysis, elements of the planning process serve as a sort of group therapy. It is a consensus building process even where participation does not result in major changes. Having been involved, having had the opportunity to voice opinions, participants "buy in" to the resulting strategies and play a role in communicating them and legitimizing them. The stakeholder is then prepared to set a direction for organizational units that corresponds to the institutional vision.[18]

Organizational leadership intent on encouraging synergistic activities is key to creating them. The leader may be a CIO but most certainly is not a "computer czar." To bring about an organizational focus where synergies can flourish requires being a major player in overall institution decision-making. The individual needs institutional leadership qualities such as being a relationship builder who listens, negotiates, collaborates, and cultivates; being a motivator of his/her own staff and others; and being a team player who applies technological vision to institutional problems, opportunities, and priorities.

Technology has advanced at a rate faster than organizations can change. Even individuals can accommodate technological change far faster than organizations. Organizations, their structure, functions, and culture have fallen behind what is needed in accommodating technological change. Organizational development and revitalization are greatly needed. When this occurs, an environment that accomodates synergy development is more likely to exist.

Creating synergies, like good management, is more art than science. A synergistic occurrence is a symptom that the organization is healthy. Synergies between technology and the organization are

characteristic of a new type of organization serving the networked society now evolving. Those who actively seek to create synergies, and are successful, will gain a competitive edge and will help to enhance the standing of their institution.

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AUGMENTATION QUOTIENT

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A Changing World

All of us have witnessed the phenomenal growth in computing resources in the last decade. We have gone from being appreciative of having access to computers for problem solutions to the state of not being able to perform a job in a functional manner without adequate computing resources. We are now in an age that we need to make sure that we fully exploit computing resources for greater creativity and productivity. To that end, this paper presents computing concepts and resources that we all need to be aware of.

Computing as a Tool

Every tool augments or extents human capabilities in some way. The hammer extends the power of our fist; the automobile extends the stride of our legs; and the computer augments our memory, computation and reasoning power. Intelligence is the combination of a person's abilities to learn to deal with the circumstances of living. Experience and knowledge contribute strongly to intelligence. The metric AQ, or Augmentation Quotient, is proposed as an estimate of the actual Knowledge work accomplished by a person with a given computer divided by the knowledge work accomplished in that same time period by the person alone (Knowledge work is the mental equivalent of physical work). The computer is a tool that, when properly used, can augment our intelligence considerably (Doherty, Pope 1986).

The concept of Augmentation Quotient was further illustrated by Doherty and Pope by the following description. Many persons, including Thomas Jefferson, have noticed what might be called the intelligence of a group. Jefferson further postulated the notion of negative intelligence in the following way. Suppose a group of people had a certain group intelligence brought about by the synergistic interaction of its members. If a loud-mouthed dullard entered the group, Jefferson concluded that the group intelligence would decrease because more of the group's time would now be spent in dealing with ideas of lesser merit. The group's new member had introduced negative intelligence to the other members.

Similarly, the AQ of some computing environments can be less than one. This implies that people working in such an environment work less efficiently with a computer than they would without it. In some cases during the first thirty years in computing, people have automated functions before they understood them well enough to take that step. This caused inconvenience and inefficiency for the users. However, in today's workplace many of these barriers have been overcome and we are now starting to operate in computing environments where the AQ is greater than 1 and growing. The use of computers by non-data processing professionals, "end users," is one of the most significant developments in corporate computing in the last decade. It is of growing strategic importance to many corporations and the

challenge for managers to satisfy the demands of users while evolving end user computing (Henderson, Treacy 1985).

AO>1

Many of us have viewed this changing world of computing resources with constant dismay and frustration. We rapidly moved from batch to interactive processing and now distributed processing with personal computers. We've seen the mainframes get larger, computing become decentralized with Mini's and micro-computers, computer power taking monumental leaps with Mini-Supers and Super-Computers and the emergence of computer communication with wide and local area networks. The augmentation factors that contribute most to productivity are:

Response Time
Software Tools
Hardware Functions
Information Exchange
Information Delivery
Reliability of Systems

To get a better feel for these factors let's review some trends and developments in computing technology. A study by G. N. Lambert at IBM's San Jose Laboratories in 1982 brought light to the fact that sub-second response can increase programmer productivity by a factor of one hundred percent (appendix graph 1 and 2). In fact the more skilled a programmer (or end user) is with computing technology, the greater the productivity will be with faster response time. To achieve increased productivity, you will need to review the host computer you are using, the communication links to the host and the workstation being utilized. There are some 15 million personal computers on desktops which has dramatically changed workers ability for information exchange and delivery. By the year 2000, noted Computer Scientist James Martin has predicted (Appendix graph 3) that most white collar workers will have one or more micro-computers on their desks. The power of these workstations and communication capability will be critical to productivity. Power workstations with sub-second response time for office applications executing on the micro-computers will be mandatory.

Our communication links of today are typically 9.6KBS with a growing number moving to 56KBS. Local area networks are leap frogging into more functional transmission capability currently at 2.5MBS to 10MBS and expectations of the next generation operating at 20-100MBS. These rates can be achieved economically over a limited distance and should be planned for greater utilization of local computing devices. The concept of Electronic Emancipation can only be achieved with maximum connectivity of computing devices. Local Area Networks (LANs) will be the first step toward this goal. The critical mass of office computing devices is now in place to fuel an explosion in electronic collaboration. To achieve greater productivity we must insure that connectivity is of the highest priority in our strategic plans. New

SMART (proper wiring and communication infra-structure for voice/video/data) buildings, fiber optic networks and local area networks are essential to achieving this goal.

Ducan Sutherland coined the term "Officing" as providing an environment for performing knowledge work and communication to happen seemlessly. Of course the appropriate hardware and communication resources are necessary, but the move toward "Groupware" or Computer Supported Cooperative Work (CSCW) is a growing phenomena that is contributing to an increased augmentation quotient. Their are a variety of software packages designed to help people work together more effectively. Some examples are: Collaborative authoring tools, project management, electronic mail, computer conferencing, calendaring, and shared knowledge bases. Since most productive work is a product of multiple individuals, it is important to fully utilize communication that involves computers. Computer conferencing and electronic mail will be a common tool in the modern office. A statement by Chess and Cowlisha is right on target. "Given the vast capabilities of the computer for general-purpose information processing, the use of computers as communications intermediaries has the potential to start a communications revolution fully as significant for the future of business and industry as was the first industrial revolution. In higher education we already see networks such as BITNET, NSFNET, SURANET, CSNET, SPAN, TELENET and TYMNET as essential tools to correspond with our colleagues on educational and technology matters. Many organizations are also establishing computer communication links with commercial enterprises for applications ranging from Financial Aid needs accessment and loan information to delivery of purchase orders. There is already a prediction that by 1990 the amount of mail handled by the US Post Office will start a gradual decline by two percent each year due to the growth in electronic communication (appendix graph 4). Groupware gives an organization the opportunity to share knowledge in an expedient manner. The availability of the proper hardware function and software tools that the end user workstation requires will increase the augmentation quotient for cost effective benefits. Word Processors without enhanced functions such as spell checkers, thesauruses and document conversion utilities can be considered a dullard to the end user. The proper software should be carefully analyzed to fit the end users needs. However, sufficient hardware and software will not overcome an end user that is not properly trained. Information Centers, Help desks and training programs are essential augmentation to create a productive end user. Common software for an institution is also important to reducing overhead for staff training, sharing knowledge between workers and creating an environment that workers can readily exchange information about software skills.

As we go about our daily decision making to implement information resources it is important that we consider maintaining an AQ>1 for our workplace. The most important factors to consider are:

- Easy Computer Access
- Rapid Response Time
- Software Tool Boxes (Groupware)
- Information Centers, Help Desks, Training programs
- Value Added Network Access
- Colleague Connectivity

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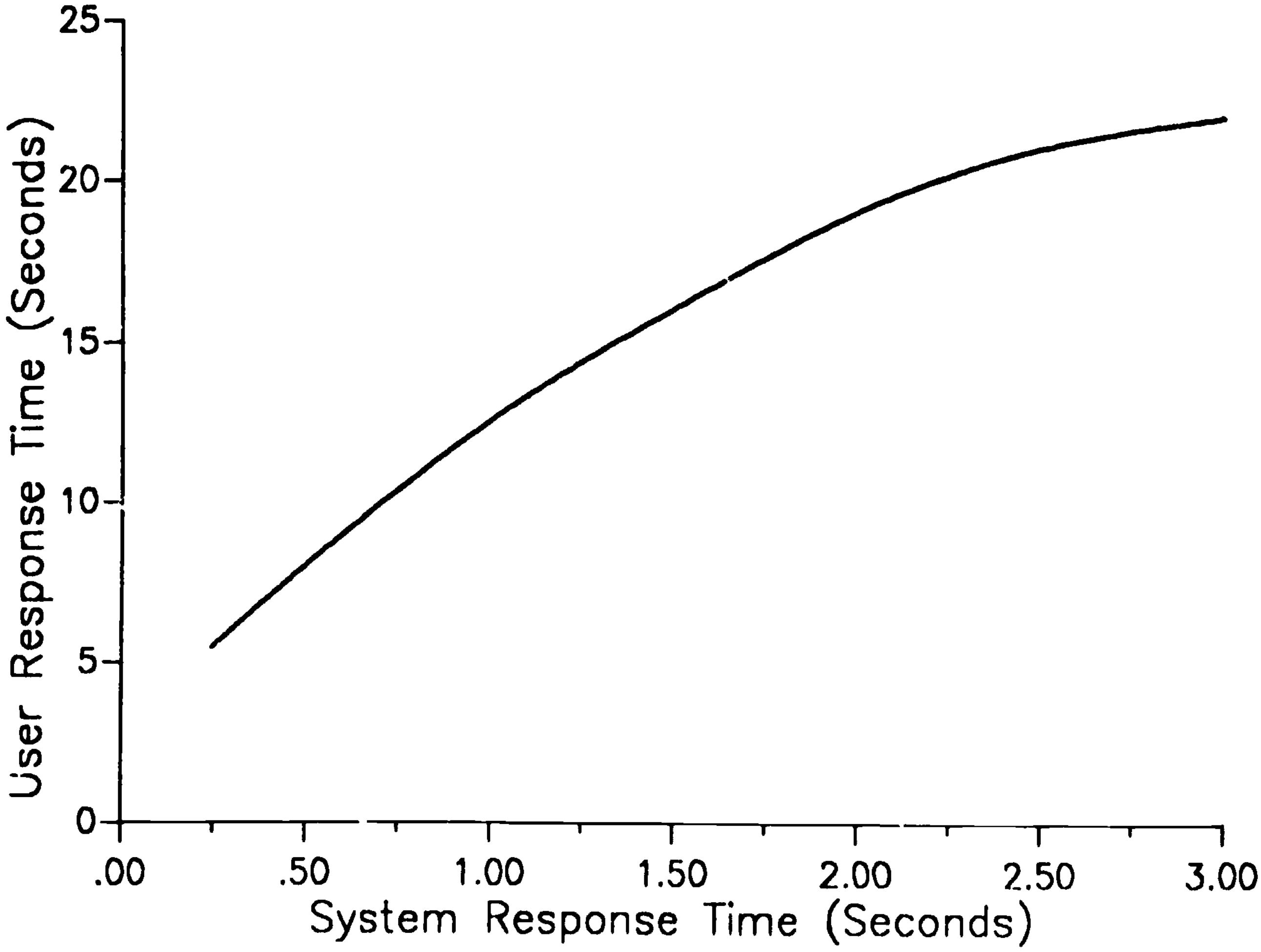
25
20
15
10
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User Response Time (Seconds)
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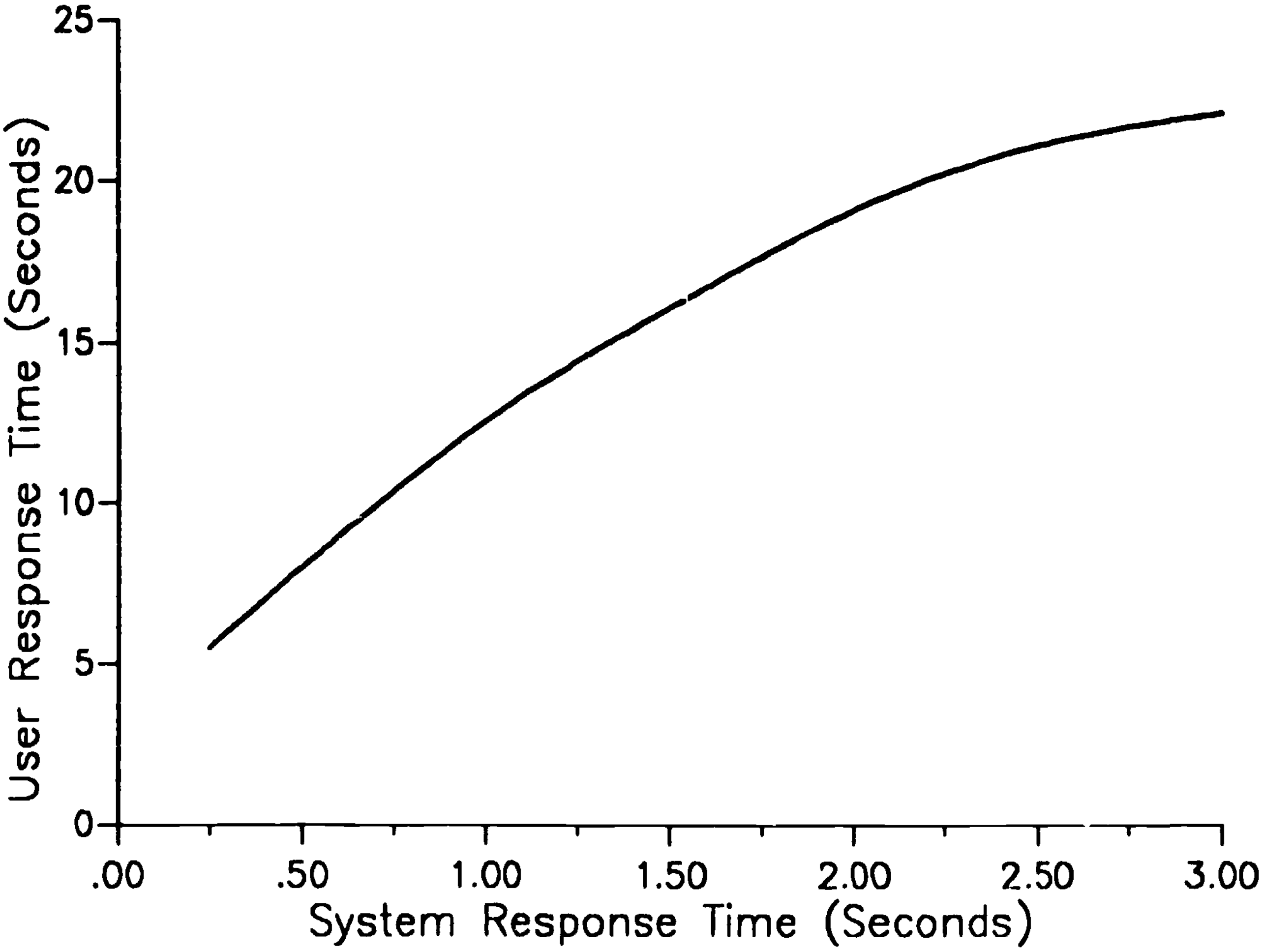
System Response Time (Seconds)

NO. 1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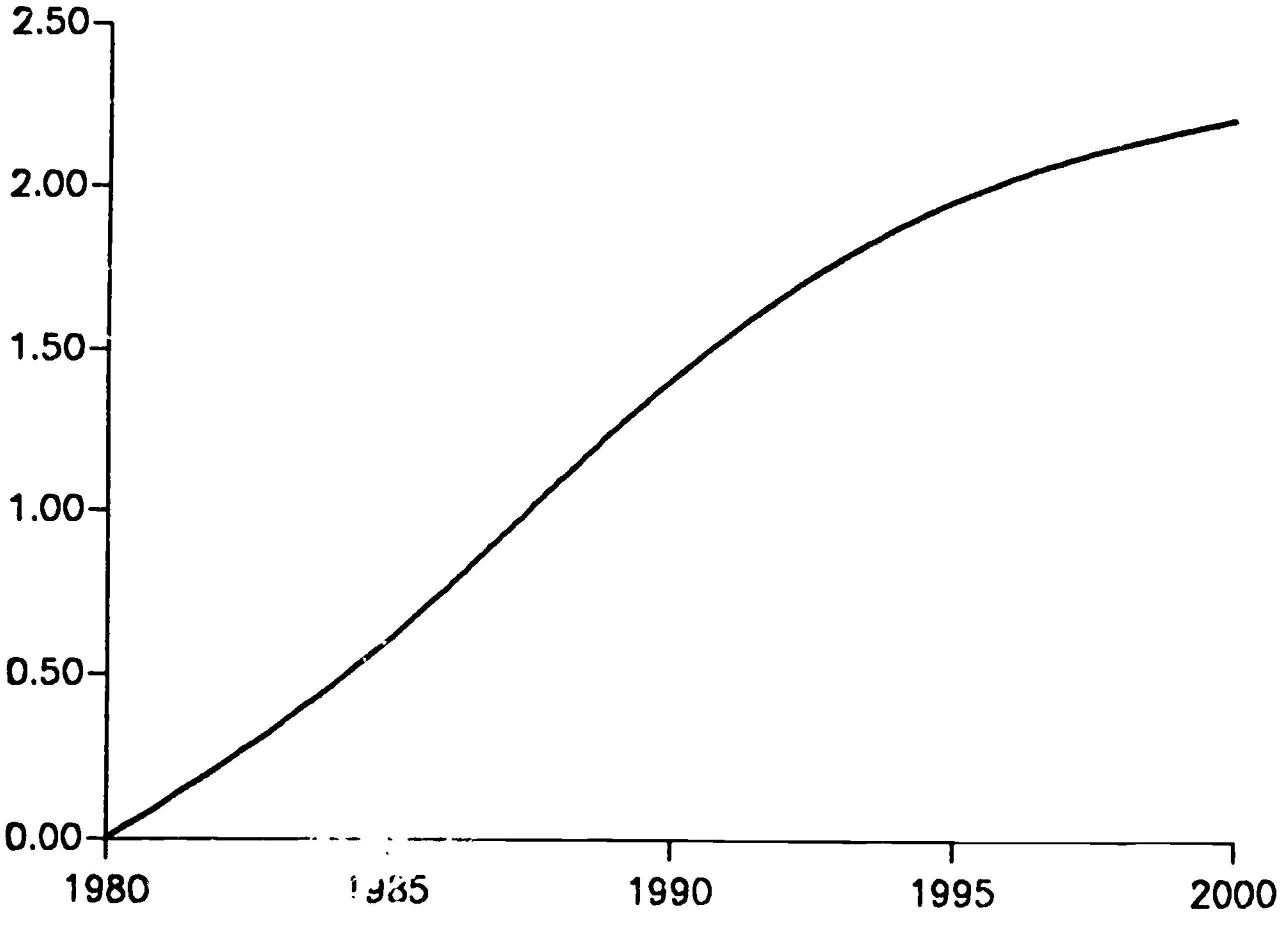
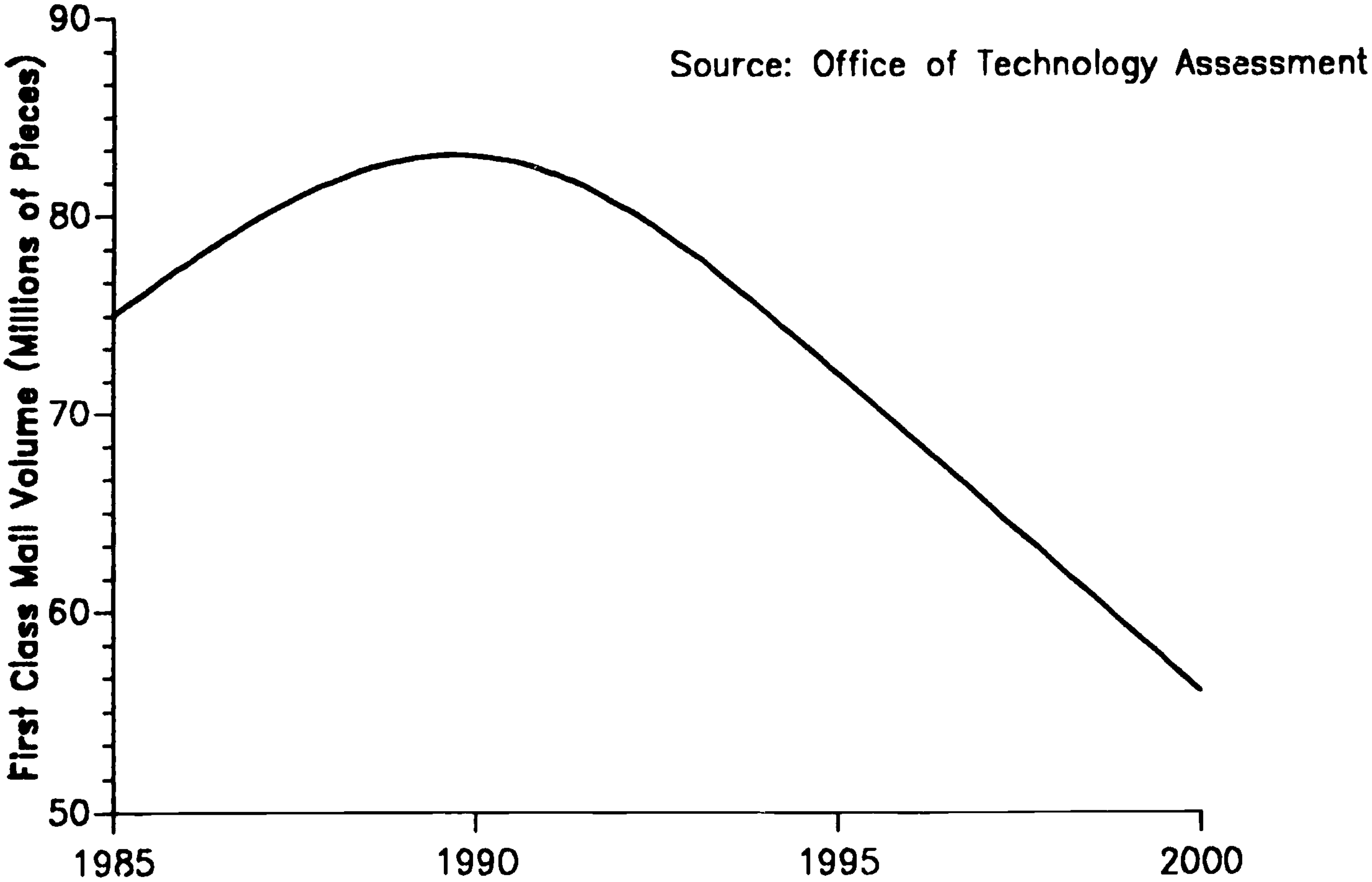
System Response Time (Seconds)



Number of Personal Computers per White Collar Worker

MAIL GOES ELECTRONIC, THE POST OFFICE DECLINES



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NO. 4

Step 2: Of Bridges & Gateways
The Linking of Winthrop College's Novell NetWare LANs

by

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--- ABSTRACT ---

In the Fall of 1986, the Academic Computer Center at Winthrop College installed three Novell NetWare LANs for instructional purposes with strategies to further develop the system if proven successful (CAUSE,1987). The LANs have proven very successful and we are now engaged in the second stage of our plans. This phase is the enhancement of "system connectivity" to provide greater access to computing resources and to facilitate systems management of the network(s).

In doing this, we have (1) linked the three LAN laboratories via fiber optic cable and (2) installed a gateway to our host processor(s). Connecting our LANs required both physical and logical conversions from the three independent LAN-unit configuration to a single multi-unit complex. Outlines of our procedures and schematics of our LAN designs will be illustrated and discussed.

I. The first step: a brief review

By the Fall semester of 1986, the Academic Computer Center (ACC), in coordination with two faculty committees, was to provide:

- a laboratory environment for the teaching of computer literacy across a broad base academic curriculum.
- general access to a variety of expensive equipment to achieve economy of scale.
- access to major application software systems and databases from central source(s) while maintaining security control over such resources.

We have since met these objectives very successfully with the implementation of three microcomputer based LAN laboratories[1,2,3].

A. The hardware

The ACC purchased and installed 3 Quadram QuadNet IX networks with NCR PC-8/AT (2048 Kb) microcomputers as fileservers. The fileservers originally had 30 Mb hard disk subsystems. Each of the three on-line fileservers has an Uninterruptible Power Supply (UPS) to protect the systems from temporary (less than 15 minute) power outages. A fourth NCR PC/AT was purchased as a backup fileserver.

For workstations nodes, we used Leading Edge Model-D microcomputers (640 Kb) with STB enhanced graphics cards and Amdek 722 high resolution color monitors. The number of workstations on each of the three networks range from 24 to 35. Main printers on our networks are Okidata 2410's, two of which attach to each of the three main fileservers. Our CAUSE87 paper[4] gives a more detailed list of the originally installed hardware.

In the last two years, we have made a number of additions to our LANs: bridges and a gateway being the most significant enhancements. In one of our laboratories, 8087 co-processors have been installed in the workstation PCs. "Bootable" ROM chips have been installed in workstations to allow them to come on-line without network "boot" diskettes. Two laboratories have at least two workstations with provisions for 5.25" to 3.50" diskette conversions. Each fileserver has an extra 44 Mb hard disk storage subsystem; total storage capacity is now at 74 Mb per fileserver. We also have extended the LAN

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[4] Leveraging Information Technology.

beyond the class room with connections to faculty conference rooms and managers' offices. For some of these connections we are using ARCNET. Users also have access to printers and a plotter outside of the classroom. Much of this has come about by user requests for increased services.

The ACC is responsible for the maintenance of all LAN equipment. We do cursory diagnostics and minor repairs. This involves, for example, splicing broken wires, replacing faulty disk drives, memory chips, and controller or communications cards. We have several vendors under contract for both general maintenance and time and materials repair of our LAN hardware. We do not carry on-site maintenance agreements with our vendors for repair of micro LAN hardware since this arrangement proves too costly. It is more cost-effective for us to purchase spare units and parts for replacement, and deliver units in need of repair to the vendors.

Maintenance and repair costs are constantly monitored. In many instances, the outright purchase of a new component with its included warranty is more cost effective than the repair.

B. The systems software

The originally installed systems software had many valuable features. Novell Advanced NetWare/286 2.0A supported up to three parallel and two serial network printers per fileserver and 255 nodes in a ring-of-stars topology. The system is token passing, updating the token list for new users automatically. It has multilevel security protection for both users and files. In addition to the high data transfer rate (Proteon, 10 Mb/S), features such as memory-to-memory data transfer and disk directory hashing and caching have contributed to the high performance of the LANs.

Our current Advanced NetWare network operating system (SFT 2.12) gives us enhanced security, data access synchronization, directory and file services, messaging, and software protection, and accounting. An excellent technical report on these features is provided by Novell[5].

C. The applications software

We have 63 software packages on the LANs and 82 courses using the laboratories in structured classes. Table 1 provides some information on the kinds of application software used by the academic departments. Information on software originally installed is provided elsewhere[6].

Major software applications are included and categorized as spreadsheet and graphics (SSG); database management (DBM); word processing (WP); business and business games (BBG); compilers and interpreters (CI); and communications (COM). Various campus agencies and students make use of our walk-in facilities. The major academic departments with structured laboratory instruction are Management (MGT); Marketing, Economics, and Fashion Merchandising (MAR/ECO); Accounting and Finance (ACT/FIN); and Computer Science and Quantitative Methods (CSC/QM).

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[5] Ronald E. Lee. Advanced NetWare: Theory of Operations, Provo, Utah: Novell, Inc., (1987).

[6] Leveraging Information Technology.

Each entry in Table 1 represents the number of software packages used by category and department. Some overlap exists in the specified categories. As an example, several of the software packages listed in the spreadsheet category are template-oriented with direct business applications. Many miscellaneous software applications are not listed.

Table 1
Software packages by academic department and category

		- - - - Academic Department - - - -			
Software Category		Managment MGMT	Marketing MAR/ECO	Accounting ACT/FIN	Computer Science CSC/QM
Spreadsheet and Graphics	(SSG)	3	3	5	1
Database Management	(DBM)	1	1		1
Word Processing	(WP)	1	1	1	1
Business and Business Games	(BBG)	4	7	1	2
Compilers and Interpreters	(CI)	1			7
Communications	(COM)				3

II. What's happened since: usage growth and problems of success

A. Usage statistics

With the announcement by Novell of an accounting facility in their revision, SFT 2.10, we chose to wait for this option rather than acquire an OEM accounting package. After installing the system software revision this Fall, we encountered a problem with the accounting function. The current upgrade to SFT 2.12 appears to correct this. However, we have not had the time to properly reassess this function since it involves reinstalling all accounts.

Since the first implementing our LANs in the Fall of 1986, we have recorded, manually, data on laboratory usage by having student operators make head-counts hourly in walk-in laboratories. We record course enrollments for classes scheduled in instructional laboratories. Winthrop College's Continuing Education Center makes use of the microcomputer LAN laboratories on an as-available basis.

Other special activities such as faculty-run computer camps also use these resources. Most of this data has been recorded. Both head-count and instructional lab enrollment data is reduced to student-hours per laboratory per semester and included in Table 2.

Table 2
Student-hours usage of LAN laboratories

Semester		---- Business ----		-- Computer Science --		
		Lab 1 (WI)	Lab 2 (IL)	Lab 3 (WI)	Lab 3 (IL)	TOTALS
		28 wkstns		*29 wkstns*+		
Fall	1986	9,831	10,000		13,789	33,620
Spring	1987	12,915	8,477		11,676	33,068
Summer	1987++	3,318	2,692		50	6,060
Fall	1987	9,291	7,512	5,101	12,927	34,831
Spring	1988	12,245	5,636	3,483	11,026	32,390
Summer	1988	2,381	4,490		1,126	7,997
Fall	1988+++	11,998	2,875	5,603	11,875	32,351

+ Other workstations (wkstns) are connected to file servers, but not located in the labs. These are not included in the lab counts.
++ Estimated value based on relative walk-in, instructional lab use.
+++ Projections were made from November 1, 1988 to the end of the Fall 1988 semester.

B. Coping with growth and success

Some of our greatest problems are those associated with increased user demands on our current facilities. Impacts have been on all LAN components: hardware, systems software, and applications software. And, as with any user service, our personnel haven't been spared the effects of resource demands by the users.

Network hardware. During the Fall and Winter semesters, users place heavy demands on the microcomputer LAN laboratories. It is not unusual to have students waiting to get into the laboratories before scheduled opening and to have them request extended hours after closing. Students share their class passwords with their peers adding to the load. Faculty and staff who have student assistants send them to the laboratories to handle work assignments. Many faculty, especially those who teach using the micro labs, have PCs without hard disks and printers. Access to the labs is a necessity for them.

To try to alleviate this need, we extend our hours and allow instructional labs to be opened for walk-in use. PCs, printers, and other devices are connected outside of the laboratories in conference and terminal rooms to provide more work sites.

System software. While we were happy with our original version of the Novell system software (Advanced NetWare/286,2.0A), it lacked several desirable features, one of which was internal accounting. We have proceeded to upgrade our systems software and with each upgrade came the usual problems associated with revisions. A particularly perplexing problem was encountered when we attached 3.50" drives to some of our workstation nodes. The then version of our operating system software was incompatible with an upgraded DOS 3.30. This problem was not immediately evident at the systems' level and manifested itself in random problems with the application software.

Our current version of Novell NetWare (SFT 2.12) offers many valuable features. These features are all administered by network servers running the operating system software. There are 25 technical manuals and 49 program disks associated with our last revision. The software is so voluminous and complex that subtle hardware problems in the fileservers can prevent it from being loaded. Working with the system software requires a dedicated, technical person or persons.

Application software. There has been a plethora of requests for the installation of software applications on the networks. The ACC is removed, and justifiably so, from making decisions on the relative merit of academic applications used on the LANs. These decisions are handled in the academic arena and requests are almost always granted. Our decisions on installing software are based on the technical and administrative side: does it work in the network environment and do you have a license or permission to use it? Resolving these two issues is difficult. On many occasions, software is purchased or acquired from associates or textbook vendors and the ACC is requested to install it "today," before either technical or administrative issues can be resolved.

Another problem is worth mentioning. It pertains to maintaining software standards on the LANs. This problem arises from requests to install major application software package look-alikes. We do try, as much as possible, to limit comparable software packages to one-of-a-kind. On many occasions a faculty member will be given some special "add on's" to a similar application in order to have us use another vendor's spreadsheet or database. We are thus continuously trying to enforce standards on types of software packages. We would otherwise be duplicating many major software packages for the sake of a few non-essential features.

Personnel. Demands on our personnel resources are tremendous and we have not been able to acquire full-time staff beyond that reported previously[7]. We rely heavily on student assistants. A major problem now is that the complexity of our operation has grown considerably beyond what we can expect from student help. The learning curve is such that capable students are ready to graduate by the time they become proficient in networking operations.

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[7] William J. Moressi and C. Brown McFadden, "Students as Academic Computer Center Personnel," CAUSE/EFFECT, 10(4) (July 1987): 14.

III. The second step: expanding LAN connectivity

Two issues became evident to us after installing and implementing our three LANs: (1) our management and operations of the LANs were inefficient and (2) our use of available software and hardware resources was not optimum.

LAN laboratories are in two different buildings, one of which is the Academic Computer Center. With three separate LANs, we had to process updates to application and system software and install accounts at all three sites. Also some software and hardware resources are not available on each of the fileservers. Bridging of the LANs would improve the optimization of operations and existing resources.

Also, desirable, alternate computing systems (non-Novell) were not accessible to users on the LANs. As an example, one of the LANs is conveniently located adjacent to our host minicomputer system. Microcomputers on this LAN are connected to the host minicomputer outside of the network via serial communication ports. Network workstations nodes did not have access to the host minicomputer computer. This access is especially desirable since our host computer, in turn, communicates with the mainframe computers at the University of South Carolina (USC) via a SNA interface.

Additionally, since the University of South Carolina is a BITNET node, any user connected to the host minicomputer has access to USC's mainframes and thus to BITNET. A gateway connection to the host minicomputer would increase, by way of synergy, the functionality of the LANs for all users.

Our next step was a natural consequence of optimizing the use of our original microcomputer based LAN facilities. This step was to provide

- distributed data processing beyond the scope of the laboratory environment.
- access to a greater number of computing resources for a user at a specific site.

Bridges and gateways were the instruments for obtaining synergy in the use of our resources. We use the term "bridge" to connote a connection between similar systems, as when we "bridge" our three separate Novell LANs. The term "gateway" is used to connote the connection of dissimilar systems, as when we provide a "gateway" from the Novell LANs to our host super minicomputer system (Eclipse MV8000).

A. Internetwork bridges: connectivity between LANs

The interconnection of our three microcomputer networks is realized through the provision of local bridges. Local bridging is automatically performed by the Novell network operating system.

Logical organization. Where we once considered reducing the duplication of software on interconnected networks, we decided on an approach providing greater reliability. This approach has been to make much-used, application software redundant on all three fileservers. Less critical software applications would be maintained on one or, at most, two fileservers. The cost of this increased reliability is, of course, more use of disk space.

The effect of this decision was to make each of the three networks capable of independent operation while working as a functional whole through the internetwork bridges. Figure 1 is a schematic illustration of this logical arrangement.

The decision to implement this type of arrangement proved most prudent a month after we completed the project. Lightning effects took down two of the three fileservers in mid-semester operations. We were able to shift immediately most applications and workstations to the one remaining server in another building. We installed an alternate PC/AT as a fileserver using the Alloy back-up tapes. We did have to wait some time for the return of the other two repaired units. However, we were able to restore most functions almost immediately thanks to the network design.

Physical organization. Network links are illustrated in Figure 2 and show the fileserver and cable layouts. Note that we have included ARCNET extensions in our diagrams. We alluded to this previously as "reliefs" to pressure from users for access to network facilities other than through the laboratories.

The two LANs adjoining each other in one building are bridged conveniently through respective fileservers. These LANs are subsequently bridged to the third LAN in the ACC building via a fiber optic cable. While we brought in a consultant to overview our plans, we did install the fiber optic link ourselves, - with extreme care.

All physical connections are operating excellently. We still have the one major problem of users dislodging the twisted pair wires attaching individual workstation nodes. We also seem to have temperature related problems in our laboratories with both heat (>85 degrees Fahrenheit) and cold (<68 degrees). Securing the wiring in Panduit and maintaining temperature with separate control units in each lab keeps these problems at a minimum.

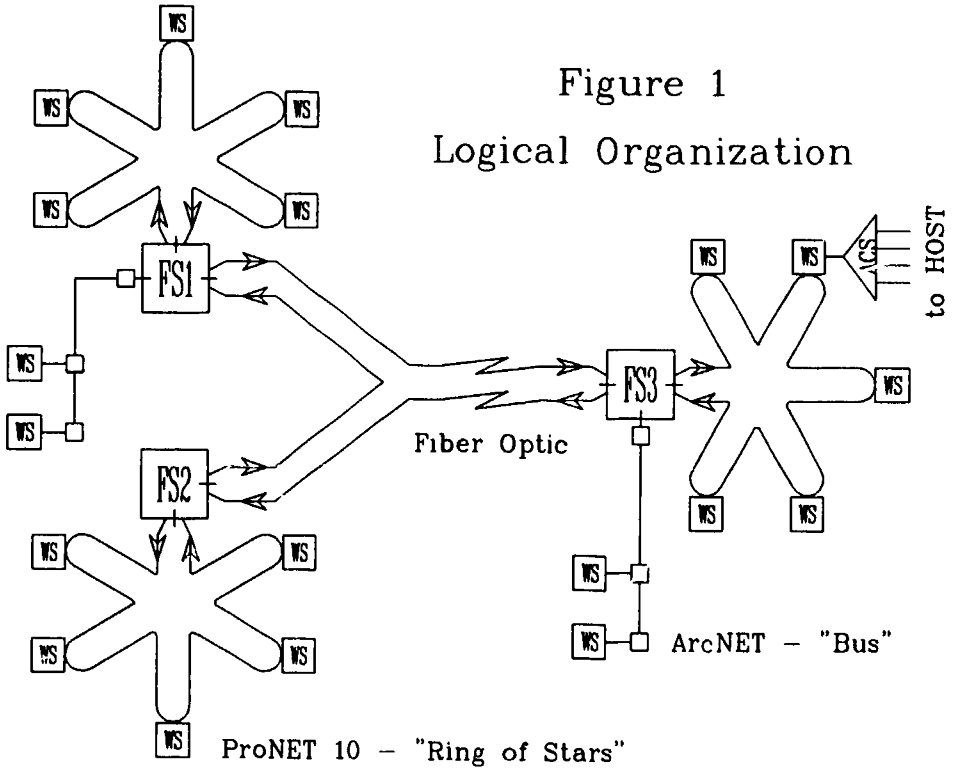

Figure 1
Logical Organization

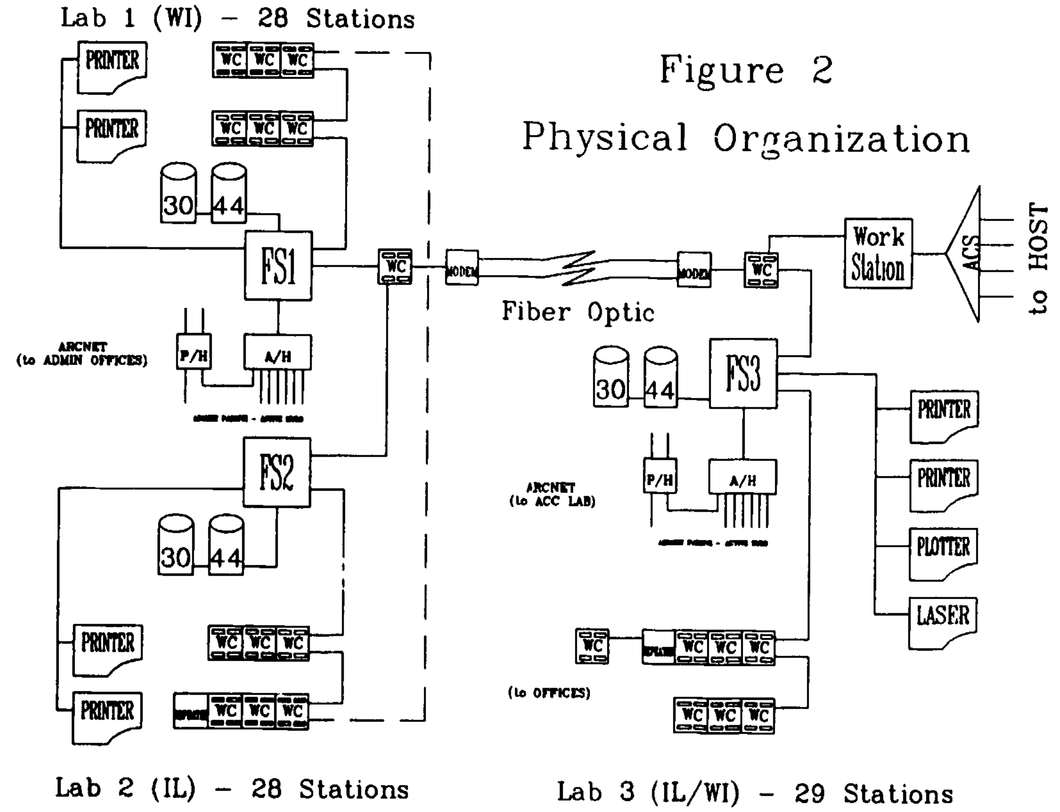

Figure 2
Physical Organization

B. Gateways: connectivity to host system(s)

As of this time, Winthrop College does not have a campus-wide LAN, nor do we have any coordinated campus standards for use of information technology facilities. At local levels, each campus service center is making separate attempts to intercommunicate and share resources. The ACC's current move in this direction is the use of a "gateway."

The strong need for this connectivity is with us now. Faculty and staff involved in using the network are requesting access to our host computer via the network - with subsequent access to the mainframes at the University of South Carolina. Linking the micro LAN to our minicomputer would make a greater number of user sites accessible to the host systems.

We are now implementing the micro LAN-to-host computer "gateway" connection (Figures 1 & 2). Our first attempt at this connection was to install an Asynchronous Communications Server (ACS), consisting of four active communication ports, in one of the workstations on the LAN located in the ACC. Our ACS may have up to 16 communications ports, each of which may be connected to a modem or directly connected to minicomputer, mainframe computer, or remote workstation. (The ACS is the gateway that will allow us to communicate with our host minicomputer system and to the mainframes at USC.)

While the ACS functions well, the first software communications package (NetWare ASCOM IV, v. 1.46) we used did not. It was user-unfriendly. A user had be familiar with asynchronous communications parameters and had to address individual ports should one or another be busy. He must typically attempt to address all available ports until he succeeds at entry. This is not the type of user-friendly software we want to use on our system.

An upgraded communications software package, NetWare Asynchronous Communications Server (NACS, v.2.0) is now available from Novell that would appear to solve most of these problems. A Name Service in NACS allows network users to request access to a communications port by either a general or specific service name. If a port is not available with that general service name, the user is informed that one is not available. This Name Service allows the system to retain detailed information on specific resources (ports) when requested by the user. To date, we have received only one of several modules of the software and, thus, have been unable to test it out.

IV. Conclusion

A. Where we stand now: the connected LANs

All three independent LANs are linked (bridged) into a functional multi-unit complex. At the expense of disk space and three extra network cards, we opted for increased reliability by making each LAN laboratory functionally independent in addition to being part of the whole LAN complex. Any work station node may address any fileserver or any other node in the integrated complex. Should any one fileserver fail, an alternate on the network with similar software may be addressed. With the type of activity we encounter in the academic environment -- tightly scheduled classes and exams and special assignments; we are well served by this arrangement.

At least one course uses the LAN microcomputer workstations to access services on our host computer. There is also a growing demand to access our host syster via the workstations on the micro LAN complex. At present we have installed a four port asynchrc ous communications server as a gateway to our host computer. It is functional, but we are dissatisfied with the communications software originally available. We have on order an upgrade to that software which is to ameliorate the problems of concern to us. If, after testing, we are happy with the hardware-software functionality, we will begin immediately to expand our gateway. We see this link as critical in providing expanded services to meet the ever growing needs of our users.

B. Where we're going: the Campus LAN

In 1986 a campus committee on computer utilization was formed under the President's office. Several faculty, a representative from the library, management information systems, and academic computing were assigned to the committee. With the President's concurrence, the committee chose to attack the problem of information technology standards on campus by way of proposing a campus LAN. We have since surveyed the campus for existing central processors and communications equipment, invited interested vendors for presentations, and visited outside LAN installations.

The committee is putting in place a set of generic specifications that involves the use of a computerized data switch (to take advantage of existing wiring in buildings) attached to a campus wide LAN. We expect to use fiber optics as a backbone with either a token ring or Ethernet topology - or a combination of both. Winthrop College must try to coordinate the use of existing and future information technology resources in order to provide its faculty, staff, and students with the necessary tools to aid them in their respective instructional, administrative and learning processes. The campus LAN project with the major information service centers (library, management informations systems, and academic computing) at its core is the primary vehicle to accomplish this very difficult task.

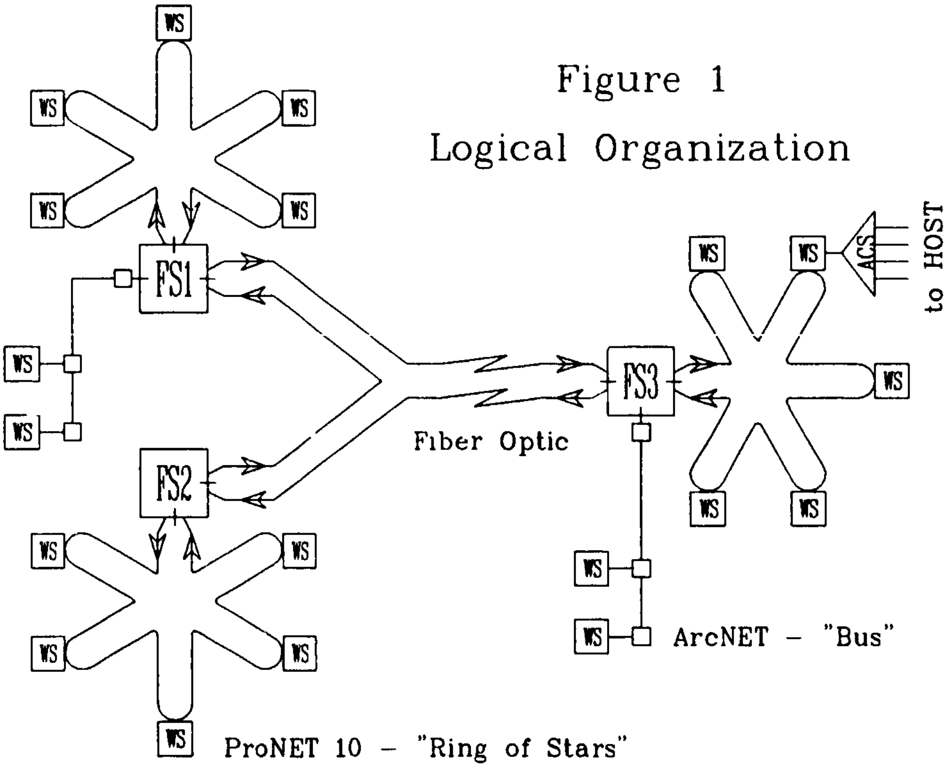

Figure 1

Logical Organization

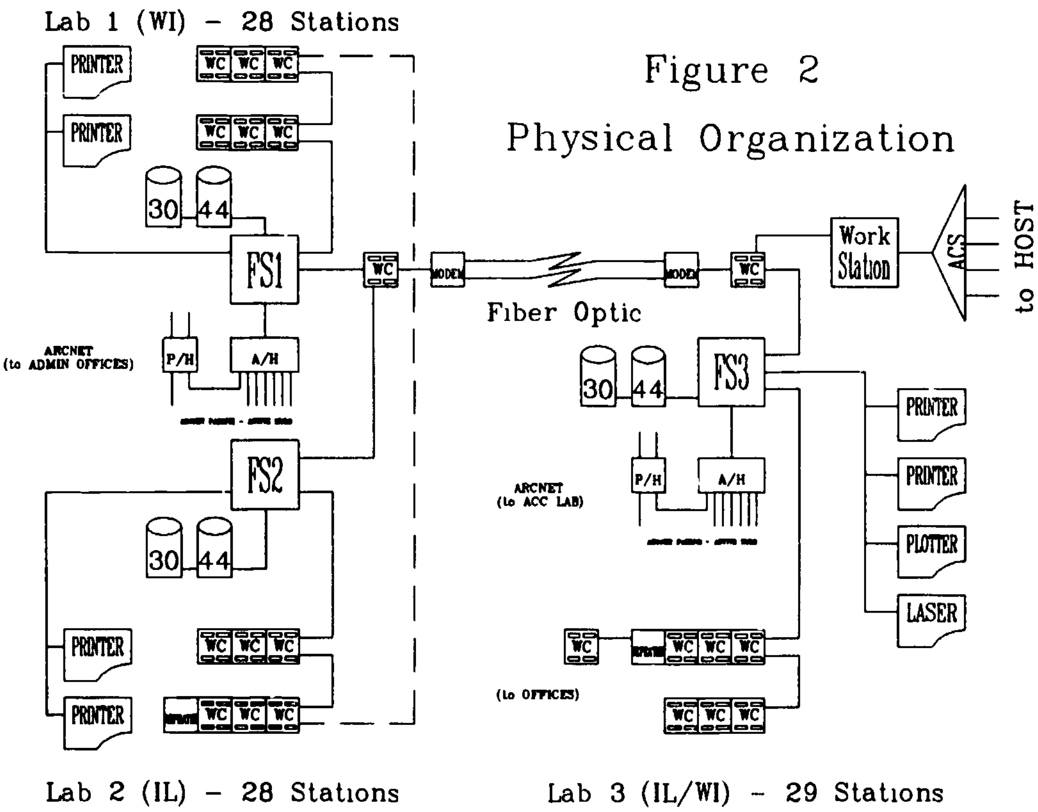

Figure 2

Physical Organization

WHICH COMES FIRST - THE PLAN OR THE SYSTEM?

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ABSTRACT

For the past eight years, Baylor University has been moving toward an integrated information system. During this time the target system has continually been moving with new technological developments ranging from microcomputers and networks to relational database systems. Baylor has adopted a strategic view of our computing future which allows for change. An empowerment staffing process is being used. This involves concentrating on getting superior performance and developing strong, capable leaders. The development of the network has allowed for some unique opportunities, including the use of the MacWorkStation software to access mainframe information. An ethernet system that ties into departmental AppleTalk networks has been set in place and provides the necessary connection of workstations to information and LaserWriters. More functionality and communications capabilities are being added based on the University's strategic needs, opportunities and technological advances.

WHICH COMES FIRST - THE PLAN OR THE SYSTEM?

Introduction

In 1980, Baylor made the decision to begin an upgrade of its mainframe computer systems. This was followed in 1982 with a decision to purchase a Micom data switch and in 1984 with a decision to invest heavily in microcomputers. These decisions, although they were considered to be the major decisions at the time, were really no more important than other developments in the expansion and use of technology that have since taken place. These other developments are very appropriate topics for the CAUSE '88 Conference, "Information Technology: Making It All Fit." Key terms used to define the CAUSE '88 Conference include: change, integrate information technology, workstations, strategic use of information technology, vision of technology and risk. All of these have been important in Baylor's technological development.

This track on how policy planning, implementation and organization affect strategies for hardware, software and networking is an appropriate place for us to share our developments. Baylor is making major changes in these areas. In making these changes the question has been asked, "What is our strategy?" I would like to discuss this first.

In 1980, the microcomputer was not taken as a serious alternative for the desktop workstation. In 1984, when our microcomputer revolution started, the network was still seen as twisted pairs of wires connected to a data switch. A traditional planning process, which requires that we need to know where we are going, our destination, in order to get there, would not have served us well in that it would not have allowed for the microcomputers that now outnumber computer terminals on our campus or the ethernet network that is essential to meet our present needs. We never know when new technological opportunities will arise.

In a sense, we are much like nomads in the desert. Each morning we get up, look at the sky, the weather, the grass, consider the season and decide whether to stay another day or pack up and move on. Which way we move depends on what we have learned from the past, what we see today, what we guess about tomorrow and our ultimate desire to survive. For us, the destination which we cannot see, or define, is not what the counts most, but the journey - a journey into unknown lands with unanticipated results.

In order to deal with this uncertainty and change we have adopted a strategy like the strategic view that is described by Robert Heterick in the recent CAUSE publication, **A Single Systems Image: An Information Systems Strategy.**[1] He states:

> Classical approaches to planning usually emphasize the establishment of goals. In a time where technology is growing and changing so rapidly, such a static approach is clearly myopic. What seems more fruitful is a strategic view of the institution's computing and communications future - a view that attempts to articulate a growth philosophy that permits seizing opportunities when the state of technology is right. Some technological advances are clearly predictable; others are not so easily foreseen. Whatever strategic position the institution assumes vis-à-vis computers and communications, it must be predicted on foreseeable technological advances and be flexible enough to accommodate those that are not so easily discernible.

This concept was also set forth by John Morris in a presentation at EDUCOM'88 where he used the term strategic thinking. He said, "Real strategic planning seldom occurs through formal planning processes that embrace all issues. It occurs though problem solving, planning that addresses one of the critical issues that is important and changing. ... Enemies of strategic thinking for information technology are organization, politics and process barriers, not technological barriers."[2]

As a physicist, I am reminded from time to time that the discoveries that have lead to Nobel prizes in physics have not come through planned experiments, but through unplanned observations and accidental discoveries. Likewise, the major advances that will come to our technological developments will come through this type of strategic thinking, not through the normal strategic planning process.

I would like to summarize the three issues that are important to our strategic view and then discuss them in more detail. They include leadership, the staffing process and advancement.

1. Leadership: If we want to be a leader in making information technology of strategic value to our institution, we must make advances in its use. Being a leader involves being willing to take risks. How would you like to be known as the person who purchased 250 DEC Rainbow microcomputers? That is risk taking. The low risk decision was to purchase 500 IBM-PCs for resale to students and faculty, six weeks before IBM dropped their prices significantly and the bottom fell out of the PC prices. It is easy to tell the leaders from the followers in these situations, they are the ones with the arrows in their backs.

2. The Staffing Process: Advances in a rapidly changing technological environment are made through creative exploration and experimentation, not through planning processes, and the key to these advances is the staff.

3. Advancement: The two developments that are now playing the major role in our advancement are the workstation and the network.

Leadership

Campus leadership in computing technology varies from what several years ago was called a computer czar, who at best is a benevolent dictator, to one at the far end of the spectrum who is only a moderator over a totally participatory democracy where everything is decided by committees and consensus. The computer czar has the advantage of being able to respond instantly when new opportunities arise, but as David Stonehill has noted, the only thing shared in common with a czar is the potential to be assassinated.[3]

The moderator offers great potential for politically acceptable decisions whose timeliness will, on occasion, leave us a generation behind in our developments, or when consensus cannot be reached, allows everyone to do his own thing in his own way. It is a great way to win the battle, but lose the war. How many campuses that let each department or individual choose their own microcomputer and word processing software several years ago are now trying to get everyone together so they can communicate with each other? The old western saying put it this way, "If you want to head the Indians off at the pass, you have to get there before they do."

Our leadership methods need to operate somewhere between these extremes in order to have acceptance of decisions that affect others' work places, and they need to be able to

respond in a timely way to technological opportunities in order to prevent future problems.

Three characteristics that are needed in todays technological leadership are a willingness to take risks, an entrepreneuerial approach to problem solving and the ability to instill a vision of what is needed.

The Staffing Process

The one area where we cannot afford failure is the staffing process. An excellent staff can make up for hardware and software mistakes, but the best hardware and software systems can fail without a quality staff. Computing developments on campuses have changed from needing an organization that stresses productivity and efficiency to one that must have superior performance. The term that has been used to describe our staffing process is **empowerment**. It has six characteristics.

1) **Selection**: Staff members must be aggressive, technically competent, have an excellent education, additional educational potential, thrive on responsibility and be able to work as a team member.

2) **Delegation**: Our delegation of responsibility must be clear and focus on ends, not means. We must clearly state what needs to be done but not how it is to be done. We must accept risks and allow our staff to make mistakes and fail. Most of us learn more from our failures than from our successes.

3) **Vision**: It is essential that we give our staff a vision of what can be. This vision will help establish the need for and acceptance of change. This vision must become their obsession.

4) **Development**: The staff must be given opportunities to continually develop their technical and management abilities. This involves coaching, teaching and providing new opportunities.

5) **Encouragement**: It is essential that we help staff members believe in themselves by giving them the feeling that they are worth something. We must communicate the belief that they can do what needs to be done and show them that we trust them by assigning them the responsibility of doing it.

6) **Support**: We must support their efforts to achieve, by accepting and even praising their failures, by criticizing as little as possible and by cutting the red tape that is normally the greatest hindrance to our making progress. We must help them build self-esteem.

It is important to realize that in order to obtain the best staff members we must pay a competitive salary. If you don't pay for the best, you won't get the best results. The university administration must understand that if technology is going to be of strategic value to the university's future, it must be treated as such, and the necessary qualifications and pay scales are not the same as those in the accounting area.

At Baylor, we have continually pushed our staff to advance academically. We first look for people who have a master's degree. If we cannot fill a position with a person at this level, then we employ a bachelor's degree individual who has the desire, initiative and ability to work on a master's degree part-time. The majority of our professional staff are either taking courses every semester or teaching classes in academic departments. This

helps our staff continually realize that at a university the educational process is the bottom line.

Douglas Swords in a recent article stated, "In any senior leadership position, qualities such as leadership, aggressiveness and vision should be top requirements."[4] Providing the staff with a vision of what can be is a part of the strategic view that we must adopt.

One warning needs to be included concerning staffing issues. For a number of years, top management at Baylor has encouraged the use of management by objectives (MBO), and this last year a university-wide, personnel performance appraisal was instituted. The Senior Staff of the Center for Computing and Information Systems went through an Effective Management Program this past year which included training in a number of management areas. We were drawn into these processes, which sound good. I have, however, observed firsthand that these were a mistake, and I agree wholeheartedly with comments by Peter Kapsales from the AT&T Bell Laboratories who states, "Performance appraisals and MBO's sound logical, but unfortunately, in reality, they are destroying the competitive position in industry in the U.S." He adds that world renowned quality and management expert W. E. Deming, "includes performance appraisals and MBO's as two of the seven deadly diseases that thwart the productivity of companies."[5]

The word empower means to give authority to or to authorize. A synonym is enable. In summary, this empowerment process allows us to authorize an individual to do a job and to enable him to complete it and be successful.

Advancements

Universities have been striving for years to develop the ultimate information system. Baylor has purchased and installed a new Student Information System (SIS) from Information Associates and we are installing the DB2 relational database version of the College and University Financial System (CUFS) from AMS. We have in-house developed CODASYL database Alumni Development and Human Resources Systems. A MICOM data switch connects our terminals and microcomputers to five different mainframe systems. Two years ago things were looking good.

Then, just as we think we are getting things under control and beginning to see light at the end of the tunnel, we realize that the target we are shooting at has moved, again. The Macintosh microcomputer has shown up in great numbers, even in administrative offices, and everyone who has a microcomputer wants to download and upload information to the mainframes. The faculty want to communicate with colleagues a other institutions, access supercomputers, do desktop publishing (whatever that is!) and access the new on-line library system that is yet to be installed.

There are now two areas where rapid advancement is needed: the **workstation**, which is the window to the world from the desktop, and the **network**, which is the glue that ties everything together. These along with our mainframes and databases can provide us with easily accessible and timely information and functionality.

The Workstation: There are three fundamental characteristics of the intelligent workstation:

1) **Simplicity**: It must be easy to use without instructions. The true test is whether a new user can obtain the information he wants without having to use the help screens.

2) **One view**: The access to every different database or system should use the same procedures; that is, look the same: drop down menus for MACs or numbered menus, etc.

3) **Functionality**: Everything needed by one individual should be available through his workstation.

We certainly have not reached this goal, but with new microcomputer tools such as MacWorkStation we can begin to come close. We are now getting a good vision of what the intelligent workstation can do, and when the vision is clear, the results cannot be far away.

The Network: There are three requirements for our network:

1) **Transparency**: The network must be invisible to the user, who should only need to specify what type of information is needed. The workstation should navigate the network to the proper computer and system.

2) **Connectivity**: The workstation, through the network, should be able to provide or connect to all needed computer systems, information, electronic mail, word processing, databases, spreadsheets and supercomputers.

3) **Speed**: Appropriate transmission rates should be available for terminal activity, document transfer and graphics processing.

Some communications gurus are satisfied when they are able to move information around the network. This type of communications is only the foundation, however. Real networking is in place when the Dean of the School of Music can obtain the information he needs from the mainframe through his workstation, without assistance and with little training.

In order for these things to be possible, we should already have in place mainframes and systems that provide a rich variety of software tools such as: languages, database systems, 4 GL's, statistical and numerical packages and our data must be accurate, complete and timely.

Examples

There are several examples that will show our state of development and some of our successes in various areas.

Example 1: MacWorkStation

This past summer we began testing the MacWorkStation software. We had developed easy to use employee and student directories which use traditional terminal and menu access. Since more offices are beginning to use the Macintosh, we decided to develop a MacWorkStation front end for these directories, thus giving them a Macintosh view. It also makes downloading and manipulating the resulting information much easier.

One of the problems most universities deal with is the need to recruit additional qualified students. This is also true at Baylor. Each year we receive ACT and SAT scores from approximately 25,000 students who have expressed an interest in attending Baylor. Out of this number approximately 5,000 complete an application. For the most part, the remainder of these students are not contacted by the University. We have recently placed

an ACT/SAT directory on the VAX computer system that allows academic departments to have on-line access to these names, addresses and scores. This information can be easily downloaded into a word processing system. We have now tested a MacWorkStation front end to this system that allows the department to access it as if it were on the Macintosh. When they select the students in which they have an interest, these can be moved into a database system such as FileMaker. This again allows a one view workstation.

Another MacWorkStation project that we have tested provides access to information on the Student Information System. In this case, the Macintosh accesses the IBM 4381 through the VAX 8700, which makes the Macintosh communications much easier and takes advantage of our IBM ethernet connection. This greatly simplifies access to student information.

Example 2: University ID System

Three years ago we reached the limit on the number of readers that could be placed on the Validine Student ID System. A committee was appointed to study the situation and bids were requested from vendors. The Center for Computing and Information Systems submitted a proposal to the committee for an in-house developed University ID System that would allow one card to be used for all purposes. For a cost of $100,000, we were able to offer more functionality and readers than what an outside vendor could offer for over $120,000. We now have an ID system that operates on a VAXstation 2000. It is connected to the VAX 8700, which contains an intermediate database that is updated on a regular basis from the IBM 4381. The system basically functions as a network distributed database system. It has fifty readers now, and plans are in progress to add another VAXstation that will allow another fifty readers and hot backup capabilities. At this time the VAX 8700 is a warm backup system for the VAXstation. The ID System is used for cafeterias, check cashing, book store charging, health center, sports events tickets, library privileges, recreation area access, controlled facilities access and parking lot access.

Example 3: The Network

The campus network is one of those areas where we have taken advantage of timely opportunities. With many Macintoshes on campus and the LaserWriter becoming the standard departmental printer, we have an immediate need to connect departmental microcomputers to LaserWriters. We are moving ahead with the installation of departmental AppleTalk networks, tying their microcomputers and LaserWriters together, and connecting these departmental networks to a fiber optic, ethernet backbone that also connects to the mainframe systems. The network gives the immediate advantage of being able to print to any LaserWriter from any microcomputer or mainframe. In addition, most departments are being set up with a hard disk file server with AppleShare so that we can install floppy disk based MACs in faculty offices and save a considerable amount of money. Print spooling is also provided. Since the LaserWriters are attached to the network, they also can serve as the standard printer for our MASS-11 word processing that is used on the VAX 8700 as well as IBM PC's, Zenith PC's and DEC Rainbow's.

Our new Student Information System was set up to print transcripts in a batch process on a line printer. This was a very inconvenient process for our students. We set up a LaserWriter on the AppleTalk network tied to the IBM 4381 that allows the on-line printing of transcripts in the Registrars Office. This provides high quality transcripts at the time they are requested.

To connect the DEC Rainbows to the network, we worked with Centram (who developed the TOPS networking software and hardware) to construct a board for the Rainbow and modify their software so that TOPS operates on the Rainbow. This was another

opportunity that we took advantage of when a vendor was willing to work with us to develop a new product.

We also have been a beta test site for the Advintech ethernet system that attaches to the IBM 4381/MVS computer. This ethernet connection allows it to easily communicate with both the VAX and the IBM 4381/VM computer in the School of Business, where we have begun testing a BITNET connection through the primary Baylor BITNET node on the VAX 8700.

Example 4: External Network Connections

Two years ago we obtained a BITNET connection through the University of Texas at Austin using a 56 kb lease line. This lease line serves for both BITNET communications and a connection to the Texas Higher Education Network (THEnet). THEnet provides us DECnet connections with many universities throughout the state, including a connection to the University of Texas Center for High Performance Computing that provides CRAY number crunching capabilities for some of our research projects.

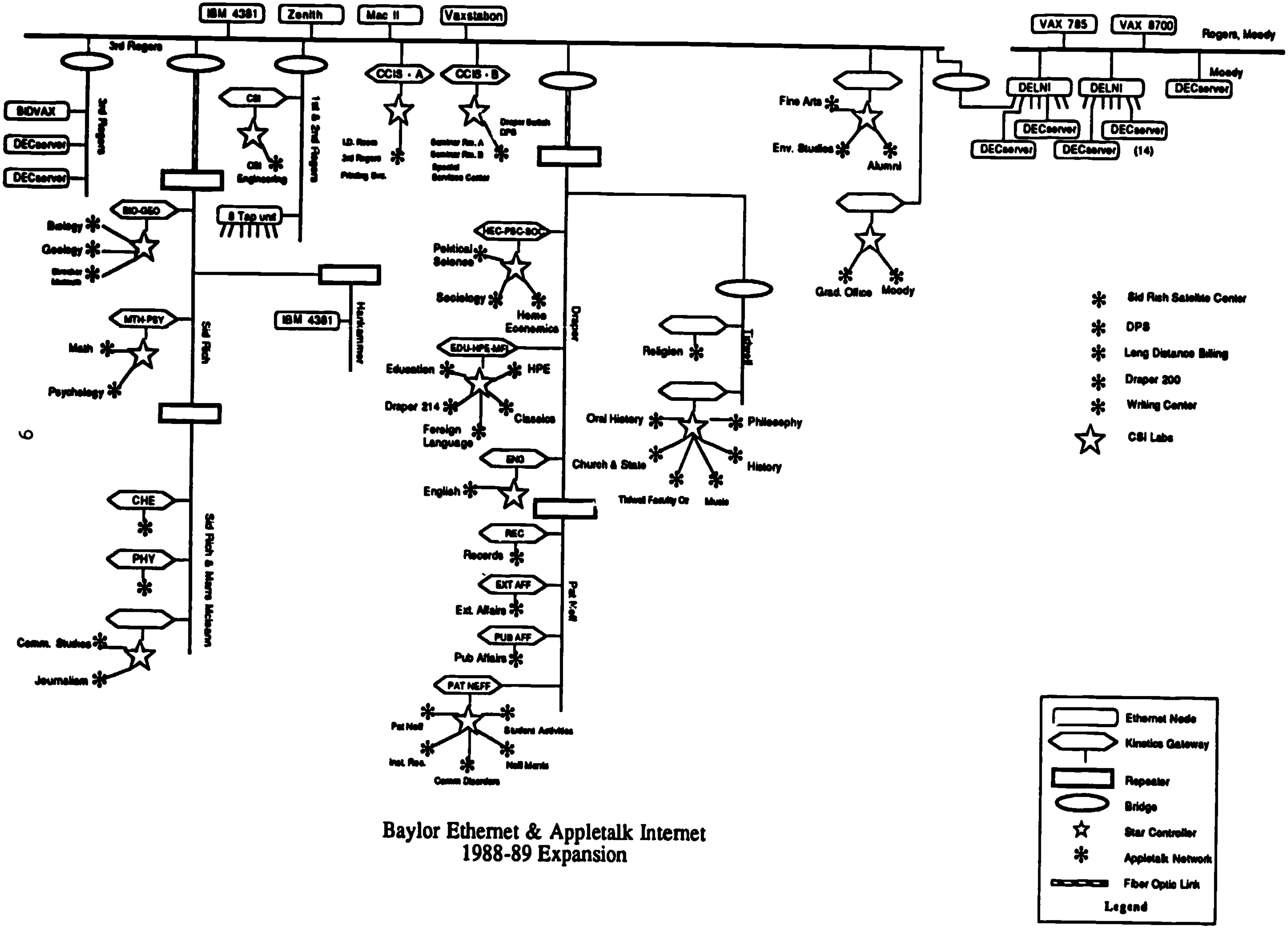
Three years ago Baylor needed to connect the microcomputers at the School of Nursing, which is located 90 miles away in Dallas, to our campus network. At that time we had started to operate our own long distance telephone network by purchasing wholesale long distance services from ClayDesta. We leased two 56 kb lines to the Dallas Nursing School which allow us to operate two voice lines and eight data lines. The voice lines tie into the Dallas telephone switch so that long distance calls placed from our campus switch to the Dallas area are routed over these lease lines. The eight data lines essentially operate free of charge on top of our student long distance sales.

Example 5: On-Line Library System

In 1983, a study was initiated to obtain an automated library system. The result of that study was a recommendation to purchase a library system that would cost $2.5 million. Because of limited resources, no action was taken. A grant for $300,000 was obtained from a foundation for us to begin the data conversion from our present CLSI circulation system to the proposed system. Since no progress was being made in obtaining funding, the Center recommended a year ago that we look for a library system that would run on a VAX computer. A VAX 11/785 was no longer needed to support student work and could now be used to support a library system. Another committee was appointed, which resulted in our selecting the multiLIS library system. This decision will not only solve many of the internal needs of the library but also give an excellent on-line, public access catalog. Since it runs in the VAX environment, it will be an integral part of our academic and office systems environment. Since any faculty member will be able to do a catalog search from his workstation, we will most likely develop a MacWorkStation front end to this system also. The total cost was reduced from $2.5 million to under one-half million dollars.

Example 6: Microcomputer Applications

There are several places where we have made good use of microcomputers tied to the network. For several years, we have downloaded class rolls to faculty members in either Lotus or Excel formats. In the Registrar's Office, we have tied an optical scanning system to a microcomputer, which allows easy input of grades which are then uploaded to the Student Information System. A microcomputer is used in the Student Housing area to provide better matching of roommates and for the assignment of rooms. Student names are downloaded to the microcomputer where room assignments take place, including dorm telephone numbers, and this information is then uploaded to the Student System.



Baylor Ethernet & Appletalk Internet
1988-89 Expansion

Example 7: Adopt Standard Products

A number of years ago Baylor had the opportunity to obtain attractive licensing prices from MEC, which developed the MASS-11 office automation products. We have continued a close relationship with this company and from time to time serve as a beta test site for their products. We use their word processing software, their dBASE type database software (on the VAX and on microcomputers) and are currently evaluating several of their new products. This close relationship with MEC allowed us to move into office automation very early, establish a university standard and provide campus wide training and support. When the Macintosh arrived, we adopted Word and Excel as the standard products and have since purchased the KeyWord product that allows us to transfer documents between MASS-11 and Word. This has allowed us to adopt a dual standard, one for the Macintosh and one for the VAX and PC. We are, therefore, trying to make all new products integrate easily in these two workstation views.

Example 8: Administrative Software

The decision was made in 1984 to begin an upgrade of our administrative computing systems and to move toward purchased software rather than in-house developed systems. A committee was appointed to select a system, which resulted in a contract to purchase the SIS/IA product along with a new IBM 4381 computer. The complete process will take approximately four years and it has followed a traditional planning model. It has expanded the functionality available for many offices on campus, but suffers from having a workstation or menu view that is different from our other systems.

Two years ago another committee was appointed to examine our financial system. The decision was made to purchase the CUFS/AMS software and we agreed to become the beta test site for their DB2 relational database version. From initiation to completion, this project will take approximately four years. It also has a different workstation view. The MacWorkStation product may remedy these different views.

Conclusion

It is important that our information system have strategic value to our institution. This is only possible if our strategy is dynamic, our staff is creative and our leadership is willing to take risks. Sir Walter Scott put it this way "One hour of life, crowded to the full with glorious actions, and filled with noble risks, is worth whole years of those mean observations of paltry decorum, in which men steal through existence like sluggish waters through a marsh, without either honor or observation."

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2 John Morris, "Strategic Planning as a Process of Consensus Building," EDUCOM 88, Washington, DC, October 25-28, 1988.

3 Linda H. Fleit, "Choosing a Chief Information Officer: The Myth of the Computer Czar," CAUSE/EFFECT, Vol. 9, No. 3, May 1986, p. 29.

4 R. Douglas Swords, "Was Your CIO an Accountant?," Mainframe Journal, September/October 1988, pp. 94-95.

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A HANDY GUIDE TO CAMPUS TELECOMMUNICATIONS

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ABSTRACT

Remember when Physical Plant handled "the phones" and the computer jocks did the data bit? All of this is changing. Campuses are encouraged to do their own thing. Are you ready?

This paper presents a layman's (simple words) view of how computer folks can look at the telecommunications revolution that is occurring. Key to the presentation will be rules of thumb and simple guidelines that will allow you to go away from CAUSE '88 knowing enough about telecom to be dangerous.

To make the concepts practical, Florida State University's telecommunications experience will be used for illustrative purposes. Data from twenty-two other universities is presented to allow you to make some comparisons to the your campus situation.

INTRODUCTION

A New Ball Game

Are you better off today, with regard to telecommunications, than you were five years ago? We were warned that there would be a period of "adjustment" after deregulation. We find that the American society is operating in a climate in which the bills for past rate excesses are coming due. Over the past four years, we have found that local service rates have gone up. There has been competition in long-distance service which has resulted in lower costs. Deregulation was intended to increase competition AND lower costs to the consumer.

But, the "consumer" did not get a vote in 1984 when Judge Greene made his famous ruling to bust up AT&T. We, the consumers, are left with the present situation of challenges and opportunities. Right!

Bah, humbug! It's a mess. And, for most of us it is just more work, more decisions, and more money. OK, so we need to have our attitude adjusted. What would a wise old man tell us?

> Life is short,
> the art long
> opportunity fleeting,
> experience treacherous,
> judgment difficult.
> --Hippocrates, 460-400 B.C.

A Difficult Judgment to Make

Five years ago, the judgment on campus was not as difficult to make. Your local telephone company provided ALL of your telecommunications services. You better believe they did. It WAS regulated and the law. Remember those good old days when the Telephone Coordinator down at the Physical Plant took care of getting phone service for us? And as for data, well, the guys at the computer center took care of ordering up data circuits. But, a lot has changed since 1984. The Deregulation of '84 has opened a Pandora's Box of decisions for you to make. Now, the judgment in telecommunications is difficult.

I was motivated to develop this Handy Guide to Campus Telecommunications as a result of my past two years of immersion in telecommunications. For the prior 20 years, most of my experience had been in computing and information systems. Sure, we computer people understand data and some of us have even been involved in microwave signaling. But, few computer managers have experience in the voice communications side of information resource management.

All of this is changing. Why? It is not solely because of deregulation. I believe that we have moved to a point in computing where networking is the real challenge of the '90s. Thus, we need to be a part of the planning, developing, and deciding about all three of the facets of communications. Yes, not just data but the voice and image components too.

Given this premise, I wanted to capture some of the important aspects of deciding about voice communications because those decisions will impact on the computing scene. And, to make a contribution, you will need to know something of the telecommunications industry to appreciate why they do things the way they do. As in computing, there is a vocabulary and jargon for the trade. So, we all have a lot to learn..

The essence of this "Guide" can be broken down into four parts. First, it will be helpful to review some historical highlights to appreciate the regulated telecommunications industry and the implications of deregulation that have an impact on the campus. Secondly, there is a need to understand the switch and whether a campus should buy one or rent the service from the local telephone company. Thirdly, there is the issue of phones. Since they are a campus responsibility now, how much do you suppose new ones will cost? Finally, wiring is another biggie. Do you need to rewire the buildings now that the local telco has given you this problem? And, how about digging up the campus to put in fiber?

It would be naive to represent that these four subjects make up the totality of telecommunications. One of the more difficult judgments that the university will have to make concerns people issues. So, as we go through the four major sections of telecommunications, expect to see some human resource issues interjected. Now, let's move to the subject of the telecommunications industry and its deregulation.

PART I -- DEREGULATION

The First Deregulation

Over the past decade, our government deregulated trucking, airlines, banking, and most recently telecommunications. Since Judge Greene's ruling in 1984, judgment has been difficult. The monopoly is gone and we have freedom of choice. We can now go to the market place and select from dozens of vendors. Before we settle down to reviewing our choices under this new freedom, let's take a brief look at history.

Did you know that 1984 was not the first time the Bell monopoly was dissolved? Almost a century ago, the Bell System patents ran out in 1894 and competition began to nibble at Bell business. Within three years, 6,000 telephone companies were established to manage 240,000 phones -- that's 40 phones for each company to manage.

Origins of Regulation

At the turn of the Century, the flourishing telephone business brought on advertising slogans like: "We have two ears, why not two phones?" But, several states began a piecemeal end to deregulation by setting up rate-regulating bodies and then Congress placed long-distance telephone operations under the jurisdiction of the Interstate Commerce Commission. Even before World War I, England and France had nationalized their phone systems. Woodrow Wilson was running on a platform that would have the Postmaster General operate a nationalized phone company. This actually happened several years later in 1918. Within a year, service had deteriorated so badly that Congress reversed itself and reverted the phone company to private ownership.

But, this period of regulation was one in which both the government and the phone company raised barriers to competition, when it was senseless to do so. Microwave radio transmission that was honed during World War II was a growth business but the FCC made non-Bell system growth difficult.Regulation moved from the ridiculous to the sublime when it ruled against plastic covers on public phone books as "harmful to the network and posing a safety hazard" to society. Yet, the force of technological advance was relentless. The Bell monopoly began to erode in the same piecemeal fashion that created it.

The Divestiture Agreement

The Antitrust Suit and AT&T Settlement

Seven years after filing its antitrust suit against AT&T, the Justice Department made an agreement with the company to drop the suit if AT&T would give up its 22 local operating companies of the Bell System. The settlement included the following points:

-- AT&T would divest itself of all exchange access and local exchange services.

-- No relationships could exist between AT&T and the divested companies.

-- The divested companies would have to provide equal access to all interchange carriers.

-- The 22 new companies would not be permitted to discriminate in favor of AT&T for procurement of products and services.

-- The divested companies would be able to provide basic services only.

-- And, watch for this "sleeper". AT&T is prohibited from being involved in the information services and electronic publishing industries until August 25, 1989.

Valued Opinions from Users

As most of you know, it gets lonely at the top. The recommendations that we pass on to top management represent our best judgment. But, these difficult judgments can be less lonely if the road we take is one that has been traveled by others.

So, throughout this "Handy Guide", some real-people experience and data will be inserted. For a national perspective, there will be survey data from Datapro, a McGraw-Hill subsidiary. It comes from a national

survey published in September 1988 which represents the experience of over 300 businesses. A campus view is presented by a survey of universities was completed this month to give you some empirical data from 22 campuses.

For ease of recognition, the survey data will be set off by indentation and bold print.

PART II -- THE SWITCH

The Issues in Perspective

The freedom of choice gives a college and university one of the biggest dilemmas it will ever face. The dilemma is whether to (1) continue subscribing to Centrex service or (2) acquire a PBX or switch for the campus telecommunications services. In the first instance, the switch will be located in the local downtown telephone company office. Or, if it is campus owned, it will be in one of your campus buildings.

The switch industry is big business and getting bigger. And, the switch is only one part of the system. The wiring both in the buildings and underground are expensive capital assets. Then, if new phones are installed, the total system cost goes up another million or so. (Oops, need to tell you that telecom people call phones "instruments" and in turn instruments are grouped under a larger equipment category call "customer-premise equipment"). Keep in mind, that because these are multimillion dollar acquisitions, the process will generate great interest on campus, and among a dozen or more vendors wanting your business.

A Centrex is a centrex.

Now, let's begin to understand what is meant by the terms. Centrex is a business telephone service offered by a local telephone company (telco) from a local central office. It is basic telephone service delivered to individual desks, the same as you get at your home. But, it is offered to businesses with more bells and whistles or features.

Centrex service was first introduced in the early 1960s and targeted small and large users with enhanced features available to all, for a price. It is marketed by the BOCs under a variety of names over the years. The most recent name is ESSX. The independent telcos also use the centrex term, in its generic sense. Western Electric produced these central office switches for the BOCs up through divestiture. Now, the renamed manufacturing arm is AT&T Technology Systems. Before and after, the AT&T switches were called ESS (Electronic Switching System) and the model number is now up to five or "Number 5 ESS". Northern Telecom, GTE, and Siemens are also leading manufacturers of central office switching equipment.

Gee! My Own PRIVATE Branch Exchange

A Private Branch Exchange or PBX or switch is the other horn of the dilemma. A PBX is a business telephone system that provides efficient and economical inside calling among users within an organization and makes efficient use of lines that tie the PBX to the outside or the local telcos and long-distance carriers. It is **private** in the sense that it is in your building, run by your people, and serves your organization. The **branch** comes from pre-divestiture days when a PBX was like a branch of a Bell System central office but located on a customer's premises. By the way, this gives rise to the phrase **premise-based equipment**. A phrase that is commonly used in the industry. **Exchange** refers to electronic equipment that controls the connection of incoming and outgoing calls, in other words a switch. The term "switch" usually means something that central telephone offices have. But, the PBXs that campuses are buying today are like those of the central office. So, the words are often used interchangeably. Like the computer mainframe business, there are a number of manufacturers of PBXs. And, it has grown since deregulation to more than 30, offering over 80 models. But, three vendors dominate the market -- AT&T, Northern Telecom, and IBM/Rolm.

Get the Facts, First

Now that the choices have been defined, what is the next step? Remembering the first function of management, the simple answer is to

PLAN. The planning process includes: (1) problem identification, (2) gathering of the facts, (3) developing alternatives, (4) analysis of the alternatives, and (5) a recommendation. If, as in the case of Florida State University, the problem identification was easy. The switch was 13-year old and the regulated company threatened to no longer maintain. In many cases, the problem is one of economics or cost-effectiveness.

Ownership versus Subscription

As mentioned earlier, "freedom of choice" came as a result of "Computer Inquiry II" of 1980. From that date, new residential and business telephones, PBXs, modems, and other end-user (premise based) devices were detariffed. I can remember that we moved into a new central administration building at the University of Maryland the early 1980s. We bought all new phones and a PBX for the building. The low bid was ITT and we experienced our first "freedom" from the Bell System.

Yet, it was not until the '84 deregulation that breaking way from the local telco became popular. Note, in the table below, that 10 out of the 13 universities have bought their own switches since deregulation. But, the real pioneers were the three who bought before deregulation, as a result of the Computer Inquiry II ruling. The table also offer a feel for the different PBXs by "brand name". It is interesting that a somewhat random sample produced a list of 13 universities that now own their switch and 9 that have stayed "regulated" or subscribing to tariffed offerings. As a way of introducing the universities that responded to the survey, they are identified in this table. Hereafter, they will not be individually identified with their data.

UNIVERSITY SWITCHES AND THEIR ENVIRONMENT

University	Manufacturer & Model	Yr in Svc	Own/Reg	Nr of Lines
Emory U.	Northern Telecom SL-100	1985	Owned	9,000
Fla Atlantic U.	IBM/Rolm CBX 9000	1986	Owned	2,000
Fla State U.	Northern Telecom SL-100	1988	Regulated	7,300
Ga Tech	Northern Telecom DMS-100	1984	Regulated	6,000
Ga State U.	Northern Telecom DMS-100	1987	Regulated	2,000
Iowa State U.	AT&T System 85	1985	Owned	12,500
Miss State U.	Northern Telecom DMS100	1985	Regulated	6,700
N. Illinois U.	Northern Telecom SL-100	1985	Owned	8,000
Northwestern U.	Northern Telecom SL-100	1984	Owned	16,000
Oregon St. U.	Bell System Centrex	1976	Regulated	4,000
Ohio State U.	Northern Telecom SL-100	1985	Owned	17,000
U. Alabama	Northern Telecom SL-100	1985	Owned	7,500
U. Cal. LA	Northern Telecom SL-100	1983	Owned	18,760
U. Central Fla	IBM/Rolm CBX	1981	Owned	2,300
U. Florida	Bell System Centrex 5ESS	1982	Regulated	10,700
U. Maryland	Bell System Centrex 1AESS	198?	Regulated	8,000
U. Miami	AT&T System 85	1984	Owned	8,900
U. Michigan	Northern Telecom SL-100	1985	Owned	29,000
U. Nebraska	Northern Telecom DMS100	1988	Regulated	14,000
U. North Fla	Bell System Centrex 5ESS	1986	Regulated	800
Stanford	Northern Telecom SL-100	1986	Owned	15,000
Tennessee	NEC NEAX 22	1982	Owned	10,000

Some Financing Concepts

Since financing a multimillion switch becomes a very real issue, it is reported that:

62% were financed through a bond issue, repayable thru telecom income
22% used the normal university capital budget
8% used joint venture capital
8% used state financing

Revenue Streams

Whether you own or "rent" switch service, there is need for revenue streams. In the case of subscribing to local telco service, it may be

important to supplement the rate structure fees with other sources of income for the overall telecom services. These other revenue sources can help provide income streams for rewiring the campus, developing networks, or expanding the infrastructure of the telco organization. In the section that follows, we will be examining several forms of income for the telco operation.

Rate Structures

Whether the campus is needing to pay the monthly telephone company bill or pay off a bond and/or keep the telecom office solvent, the university will need a rate structure for telecom services. It has at leasttwo components. The major portion of the rate is to cover the the cost of the switch, regardless of whether it is your cost or your mortgage payment for the telco's switch. The other is what you might wish to call telecom overhead, which is heavily skewed by salaries for the telecom staff.

The university rates that are presented below are provided to give you a basis of comparison. It was somewhat surprising to find that the prices of "regulated" offerings were that close to those of "owned" systems in the basic services category.

AVERAGE MONTHLY LINE CHARGES AT UNIVERSITIES

Basic Service Own	vs. Reg	Data Line	Extn	Campus Only	Maint.	Instr. Rental
$22.54	$24.77	$26.09	$8.54	$15.00	$2.50	$4.03 to $12.70

None the less, you and your telecom chief should find these numbers quite interesting because they are real and comparable. As an aside, you will probably pick up on some higher than average rates which are typically a reflection that the university is located in a metropolitan area. Yet, by and large, the rates reflect a surprising homogeneity.

Features Galore!

One difference between residential central office service and business service that occurred in the early 1960s was the announcement of Centrex Service with all of its "bells and whistles". These bells and whistles are actually tariffed features to provide better productivity in the office AND promote more revenue for the telcos. Well, you know how Americans love their gadgets. So, over the past two decades we have become accustomed to features. Even on the home front, we save the cost of another line and put in "call waiting", especially if there is a teenager in the house. But, these are really money makers since the direct cost to the telco -- yours or theirs -- is quite low. More and more features are being developed by the switch manufacturers. With each new software revision for a switch, the manufacturer announces a handful of new bells and whistles. For example, the latest software version offered in our Northern Telecom switch provides over a "gross" of features. Yes, over 144! The only higher number I've heard of is a 181-channel capable TV. Who can deal with all of those choices?

But, on a practical basis, it is interesting to note what features are the most popular. Said another way, you will want to know what features "sell" the best on a campus. Features are almost pure profit for a campus-owned switch.

When asked to list their top 5 features, our university survey produced the list shown below. And, for completeness, the next 5 most popular features are also provided.

THE 5 MOST POPULAR FEATURES AND 5 RUNNER-UPS

1. Call Pickup
2. Ring Again/Camp On
3. Call Transfer
4. Call Forward -- Immediate
5. Three-Way Calling
6. Call Forward Busy
7. Call Forward Don't Answer
8. Speed Dialing
9. Call Forward Variable
10. Call Forward Universal

Long-Distance Resale

The phrase "equal access" mentioned earlier in the divestiture agreement, makes it possible for universities to get into the long-distance resale business. As a practical matter, it could be an arrangement to reduce the cost of long distance to the faculty and staff. In other words, lower administrative costs. Yet, long-distance resale also has the potential of generating revenue. Many universities have installed or developed systems to provide this resale service to dorm students as a savings to the students AND make a small profit for the university.

The following real-life example will give you a feel for the numbers associated with an option like AT&T serving as a third-party provider of long-distance services.

AN EXAMPLE OF THE "MARGIN" FROM LONG-DISTANCE RESALE

Given 4,400 Students in Residence Halls
Assume 75% of the Students Subscribe to the Long-Distance Service
An Annual Revenue is Estimated to be $600,000
The University's Net Margin would be $100,000

Voice Mail

Another popular feature that is being offered by colleges and universities is voice mail or a voice mail box which is like an telephone answering machine. For less than 50¢ a message, calls can be routed to a personal "voice mail box" in the switch where a user's own voice asks callers to leave a message when he is not in. Subscribers can then retrieve their messages by dialing a special number.

The local telcos are gearing up to offer this service as part of their regulated offerings. Which is to say that you might not be able to offer the service to your campus, even if you wanted to do so. Yet, the pressure is building and, if price is not terribly important, your local telco can bring up this service fairly rapidly.

And, like long-distance resale, universities have an option to do-it-yourself, thanks to Judge Greene. The "system" consists of hardware and software. The third-party vendors that might be calling on you include: IBM/Rolm, Centigram, and Digital Sound Corporation, to name a few. The cost of these systems varies widely from $35,000 to $500,000 depending on the number of "mail boxes" and the sophistication of the service.

Telephone Registration

The concept of registering students for classes via a touch tone telephone and a scripted, voice response system is becoming quite popular and is a labor saver for both students, faculty, and staff. Called a telephone registration system, it is marketed by AT&T, Perception Technology, and others.

PART III -- PHONES

That Plain Old Telephone

Ever since Alexander Graham Bell called Watson in the late 1800s, Americans have "reaching out to touch someone". Today, there is a greater than 90-percent penetration of telephones in our society -- yes, that is 9 out of 10 homes in America have a phone. That makes it the top selling gadget trailed by television sets and automobiles which are at the 70-percent level. So, what do I need to know about them? For starters, we must appreciate that replacing ALL the phones on a campus is a costly decision. At a large campus, it is one of megabuck proportions. Now that I have your attention, let's discuss the basic types and some associated costs.

The POT

Now that we appreciate what a switch or a PBX does for us, we turn to "station equipment". The most recognizable piece of station equipment is

the plain old telephone or POT as it is called in the trade. These single-line phones have a physical wire connection to a circuit in the central office switch. Whether at home or in the office, one phone equals one pair of wires and a unique 7-digit telephone number. These durable and reliable old phones last decades and are the most popular category of phones on campuses today.

Electromechanical Key Systems

Because many of our campus systems date back decades, it is appropriate to describe one of the old mainstays called key systems. To get around the problem of "one number, one phone", the Bell system introduced a 1A Key Telephone System even before World War II. Featuring 6- or 10-button (key) desk telephones, these phones have advanced to the popular 1A2 key phones (1963). Although GTE, ITT, and others manufacture look-alike phones, the industry gives them all the generic name "1A2". Behind these desk phones, rather expensive components are needed. Typically found in telephone closets, there is a key service unit (KSU), the key telephone unit (KTU), and the power supply (needed for the blinking buttons).

Types of "Signaling" Phones

It seems appropriate to interject at this point that there are two types of "signaling devices" used in our phones today -- rotary dial and pushbutton. The purists refer to these as "dial pulsing" and "tone pulsing". But more on that in a minute. To be generically correct, the latter type instrument is referred to as Dual-Tone Multi-Frequency or DTMF. But, we don't call these phones by any those names, do we? Like Kleenex, we refer to these phones by the Bell trade name touch tone.

Electronic Systems

Microelectronics found its way into the telephone industry in the form of electronic key systems. These systems offer lighter, less bulky equipment with high reliability. They have become so popular that the 1A2 is no longer manufactured. These electronic phones, as the name implies, are made with integrated circuit and chip electronics. Some electronic systems still use the 25-pair cable systems to the desk phone. But, many electronic key systems use two-, three- or four-pair wiring which cuts down on system costs and maintenance.

Proprietary Phones

After the "2500 phones", the most common type of station equipment is the proprietary electronic telephone. Northern Telecom calls its proprietary phones "P-phones". These types of phones conform to the manufacturer's specifications so that the PBX/switch and phone work as a system. Some of the PBXs, such as IBM/Rolm CBX, is designed in such a manner that only its phone works on its switch. How is that for a captive audience?

Proprietary Data Phones

More recently, with the advent of digital transmission and the popularity of PCs on the desk, integrated voice-data phones or IVD phones are becoming increasingly popular. With these phones, the "codec" or the coder-decoder is located in the phone itself and transforms the analog voice (speech pattern) into digital signals right at the set. When data interfaces are added to these telephones, digital voice and data can be carried over the same pair(s) of wire, simultaneously. By the way, most of these phones do use fewer pairs than the old key systems. The normal is two pairs, the number found in household wiring. Contrast this the electronic phones that require a separate set (two pairs) of wires for data transmission.

The Old 80/20 Rule

When trying to get a handle on the proportion of different types of phones that Florida State would need to acquire to go along with its new switch, I learned about the 80/20 rule. Explained more precisely, the manufacturer (Northern Telecom) said that it was its experience that their

customers used 80 percent 2500-type telephones and 20 percent proprietary phones. When pressed about the use of data through the switch, it was conceded that 2 percent of the proprietary phones were of the IVD variety. So, to be precise, Northern Telecom has national sales data to demonstrate this rule of thumb.

THE 80/20 RULE OF TYPES OF PHONES

80% Plain Old Telephones
18% Proprietary Phones
2% Integrated Voice/Data Phones

PART IV -- WIRING

Introduction

Until recently, computer managers, systems analysts, and administrators, in general, thought little about wires, cables, and conduits. Like plumbing and lighting, we appreciated them but did not spend too much time thinking about them.

Several events in the past few years have moved the technology of wire and cables out of the background and into a more prominent front row. Consider the following aspects that have given rise to this situation.

With the **AT&T divestiture**, we have more choices than before, and probably more questions. The wiring in the buildings, like your home wiring, has become the user's responsibility. Campuses found that telcos were responsible for the copper in the ground but the university had to lay the new conduit in the ground.

Let's Talk Wire and Cables!

The data side of telecommunications has, for the most part, been piggy backed onto the voice side of systems of the telephone companies. By so doing, they have taken advantage of the existing networks and the maintenance organization for the system. Because the voice side was originally designed around **analog** signals, and most computers use digital technology, this has required the constant use of **MO**dulation/**DEM**odulation (**MODEM**) devices. This force fit has meant that the computer industry has had to make wide use of twisted-pair wire technology since its earliest days.

Twisted-Pair Wiring

The oldest type of wiring in widespread use today is twisted-pair wiring that consists of 24-gauge copper strands covered with colorful plastic coating. It is still popular because of its low cost and flexibility. And, because there is such a huge installed base of twisted pair, there is a constant development effort to increase its speed and quality characteristics for data use.

Coaxial and Twinaxial Cables

Coaxial cables, like those used on IBM 3270 terminals, involve a pair of conducting elements. But, in this case, one of the elements is formed into a flexible, hollow, pipe-like shape and the other is flexible, circular, positively charged "rod" strung through the center of this much larger negatively charged conducting "pipe". Polyethylene disks every inch or so centers the rod in the pipe while other insulating material fills out the remaining space. This produces well insulated cabling capable of much higher data speeds and the higher frequencies of broadband data communications.

Optical Fiber Cabling

In the electromagnetic or metallic cabling discussed thus far, the type of wire, amount of insulation, and number of strands have to be evaluated against cost and environmental risk. Water and lightning are natural enemies of copper cabling. And, the electromagnetic fields become an issue as the quantity and quality of data transmissions rise.

Then along comes fiber optics or FO that multiply the carrying capability over copper by 1,000 fold. Optical fiber cabling is made possible by the development of especially transparent fibers with low light loss, and such ultra-small, concentrated, reliable light sources such as a laser diodes that are capable of trillions of bits per second speed or a light-emitting diode (LED) that is a cheaper and slower technology. A typical transparent fiber, thinner than angel hair on a Christmas tree, is measured in one millionths of a meter or microns and is surrounded by a layer of light-bending cladding made of glass or quartz, which is in turn surrounded by a protective coating. A light source, such as a laser, sends analog waves or digital pulses of light down the fiber to a receiving unit that may be either a repeater that renews the signal or the receiver where the light signal is transformed back into a electromagnetic signal for input to the computer.

CLOSING THOUGHTS

The People Issue

The glue that holds all of the technology together is the "P" word. Yes, folks, we need good People to make telecommunications happen on campus. And, as has been alluded to earlier, it is difficult to transition from a few phone order takers in the Physical Plant to a University Telecommunication Department. The difficulty might be gaining the approval for the positions. But, one of the major hurdles all of us face is the classification of the position to get and retain good people. Deregulation came on the campus scene so fast that the bureaucracy of the Personnel Department has yet to catch up. In the State of Florida, there are only three classifications that exist relative to our fledging Office of Telecommunications. Try putting together a new organization of 25 plus positions with such a limitation.

Some Words from the Wise

An apt way of closing this is to call on those who make their living in the trenches of telecom on campus. The final question of the survey was: "If you could give one word (or sentence) of advice to someone contemplating the acquisition of a switch and moving toward the setting up of their telephone company, it would be? And, as you will see, some used a word -- "Beware!" -- while others could not conclude in less than a hefty paragraph. But, they are truly some words from the wise.

"PLAN! Be a telephone company!" (Florida Atlantic University)

"Don't rush. Get all the facts." (Georgia State University)

"Plan that you will, at least, double in size in cable plant and switch size."

"Plan early to become your own telephone company. Plan to manage the project, the entire installation and on-going operations, before any contract is signed." (Stanford University)

PUBLIC INFRASTRUCTURE NETWORKS:
the INdiana TELEcommunications NETwork case study

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A public infrastructure network is a telecommunications network that provides basic communication services on which public, e.g. education and government, organizations depend for their survival. An infrastructure network is distinguished from any ordinary communications facility because it is both pervasive and comprehensive! An infrastructure network provides the foundation upon which value-added (beyond merely transport and switching) information services can be exploited for competitive advantage or for service improvements.

This presentation will help its audience to:

1. Understand why current market and technological conditions motivate the creation of infrastructure networks
2. Recognize existing problems that motivate the creation of infrastructure networks
3. Describe the benefits, features, and constituencies of infrastructure networks
4. Define the services that already can and that will be supported by infrastructure networks
5. Plan, manage, and execute the activities leading to the successful creation of an infrastructure network

INTELENET, the INdiana TELEcommunications NETwork, will be used as a case study. Since 1984, the state of Indiana has been working toward the fulfillment of INTELENET which is currently being cut-over to serve its customers in Indiana government and education. INTELENET is a fiber optic backbone network that serves 16 concentration sites in Indiana where customers will access the network for transport and switching of their video, voice, and data services and to obtain other value-added information services.

WHY INFRASTRUCTURE NETWORKS?

Infrastructure networks are motivated by:

1. Communications industry changes
2. Technology
3. Shortcomings in communications infrastructure

Communications industry changes

Deregulation and new services are the major changes in the communications industry that motivate infrastructure networks. Deregulation of the industry has created a competitive climate that is compelling service providers to re-examine their pricing strategy. New services such as packet switching and other value-added features have created the prospect of considerably enhanced communications that require the foundation of a disciplined and robust network.

Technology

Technological progress in areas such as transmission and hardware has significantly improved the price-performance of network components. For example, emerging transmission media such as fiber optics possess both the capacity and other performance characteristics to substantially improve both the volume and the quality of transmission. Hardware innovations such as very-large-scale-integration significantly improve he economics of digital switching, multiplexing, and other communications functions.

Shortcomings in communications infrastructure

Shortcomings in communications infrastructure include:

1. Rising communications costs
2. Lack of enterprise-wide direction
3. Communications capacity constraints.

Communications costs have been rising dramatically. Since divestiture, the cost for local service has more than doubled! More significantly, the cost for leased long-distance private lines has gone up 10 to 30 percent at the same time.

Lack of enterprise-wide direction, i.e. no telecommunications architecture, results in duplicate carrier facilities. Nevertheless, the enterprise is still faced with limited expansion capability because the lack of planning makes it difficult, if not impossible, to forecast requirements.

For example, by 1986, inter-campus voice services provided by the Indiana Higher Education Telecommunication System (IHETS), a consortium of Indiana public and private universities and colleges, consumed a much larger proportion of its budget. As a result, IHETS was forced to cut in half the number of microwave channels it leased to transmit its video. As a matter of fact, voice services consumed more of IHETS' budget than video services.

Historically, IHETS and Indiana state government had collaborated in only a limited manner while fulfilling their respective communications needs. For example, IHETS operates the State University VOice Network (SUVON) utilizing leased phone lines. Independently, state government operates the Capitol Complex Phone System, a Centrex-based service utilizing foreign exchange and WATS services to connect the state capital with locations throughout Indiana. Within state government, a variety of heterogeneous data networks, e.g. Bureau of Motor Vehicles, Employment and Training, and Welfare, have evolved.

Simultaneously, IHETS leases a microwave network to distribute its video to Instructional Television Fixed Service (ITFS) transmitters throughout the state. This video network no longer has the capacity to increase its programming.

Communications capacity constraints are caused by the use of obsolete technology. For example, analog transmission media have much less capacity than digital media. Furthermore, digital media provide much better transmission quality!

The IHETS video network is severely limited. Its geographical coverage is limited so that it cannot be received in every Indiana county. Its programming schedule is extremely crowded.

WHAT IS AN INFRASTRUCTURE NETWORK?

The infrastructure network concept

A public infrastructure network is a telecommunications network that provides basic communication services on which public, e.g. education and government, organizations depend for their survival. An infrastructure network is distinguished from any ordinary communications facility because it is both pervasive and comprehensive! An infrastructure network provides the foundation upon which value-added (beyond merely transport and switching) information services can be exploited for competitive advantage or for service improvements.

INTELENET is the consolidation of virtually all of the communications requirements of Indiana state government and education. This consolidation creates a critical mass, especially with the IHETS video, that generates economies of scale. This consolidation creates bargaining power that can be leveraged to win cost-cutting concessions from vendors.

INTELENET is also an integrated voice and data network. It uses digital switching as well as a digital transmission backbone that efficiently manages voice and data traffic.

INTELENET is also a distinct video network that uses a separate digital video switch as well as a separate digital transmission backbone.

Infrastructure network benefits

Infrastructure networks provide cost-effective access with stable prices. The critical mass of communications requirements fulfilled by an infrastructure network will encourage its provider to offer a fixed rate for all line costs for the life (at least 5 and up to 10 years) of the contract negotiated by the network customer and its provider. Conservatively, it is estimated that Indiana will save at least five million dollars during its initial 5-year contract term.

Infrastructure networks lower the entry barriers, in terms of both technology and price, for its users. The comprehensiveness of the network umbrella makes it unnecessary for individual users to bear the burden of either network implementation or network management. In addition to lowering the cost of

services, an infrastructure can often also guarantee the capability to expand network capacity dramatically at predetermined costs because the initial infrastructure enables the provider to provide additional services at reasonable incremental cost and because the provider is in a favorable position to remain the provider of additional services.

Infrastructure networks focus attention on communications to help organizations to realize the strategic role of communications in serving customers or constituents and in delivering services.

Infrastructure network features

An infrastructure network is usually a backbone network with several concentration points where users will access network services. The backbone generally consists of transmission, multiplexing, and switching facilities that fall under the protective umbrella provided by the network provider. Infrastructure network services generally include integrated voice and data communications and often video services, as well. The motivation for integration of voice and data is efficient utilization of bandwidth as well as the opportunity for dynamic allocation of bandwidth. The motivation for video services is usually the creation of sufficient critical mass to generate economies of scale because video services require large amounts of bandwidth.

For customer support, an infrastructure network provides centralized network management and a central user help desk.

Infrastructure network constituencies

In order to be sure that an infrastructure network is managed efficiently as well as used fairly, it must be governed by a mechanism created by its constituents. For example, the INTELENET Commission was created by Indiana statute IC 5-21. Distinct from Indiana state government, the Commission is a body corporate and politic with the following responsibilities:

1. Fiscal and administrative services including:
   a. Budgeting
   b. Contract administration
   c. End-user billing
2. Telecommunications management
   a. Telecommunications planning
   b. User group interaction
3. Communications consulting services.

The Commission is composed of representatives of its customers, e.g. universities and state government, appointed by the Governor as well as selected members of state government including Indiana's General Assembly. The Executive Director appointed by the Governor is the Commission's chief administrative officer.

The Commission is a self-supporting organization that collects user fees to fund its lease payments to the INTELENET contractor and the Commission's operating costs.

The infrastructure network provider is responsible for operating and maintaining the network. The provider's responsibilities include:

1. Provide backbone facilities
2. Provide network equipment, e.g. switches and multiplexers
3. Coordinate user premise connections
4. Test and manage network
5. Maintain network
6. Generate billing

The infrastructure network customer must justify to itself any allocation of its funds to use network services.

HOW WILL INFRASTRUCTURE NETWORKS SERVE US?

At least, infrastructure networks provide basic transport and switching services. An infrastructure network is also the foundation upon which value-added information services can be implemented.

Initially, INTELENET will provide the following services with improved performance at lower cost:

1. Telephone network for Indiana higher education (SUVON) and state government
2. Video transmission service for Indiana higher education (IHETS) teaching Indiana business, health care, and other audiences
3. Private line circuits for various education and government computing networks.

INTELENET has the potential to do much more! For example, its data communication services could enable:

1. Document exchange among Indiana's libraries
2. Shared access to Indiana government and educational databases
3. Collaboration among pre-collegiate, collegiate, and corporate educators.

Video services could be upgraded to two-way, rather than one-way broadcast, capability to enable videoconferencing among government and educational personnel to reduce travel costs. Even geographical coverage could be expanded by providing gateways to national and international networks!

THE INTELENET CASE STUDY

Project history

The initial motivation for INTELENET was born in 1983 when IHETS formulated its "1990 Plan" for a significant upgrade to its analog microwave network that supported its ITFS broadcast video network. Realizing that it would be unlikely to get legislative approval for the capital investment necessary to construct this upgrade, IHETS enlisted the aid of Lieutenant Governor John Mutz who chaired a committee which recommended the creation of INTELENET. As a result, Governor Robert Orr established a steering committee and task force in early 1985 to examine Indiana's present and future communications requirements and to determine the feasibility of a consolidated statewide network.

After six months of study, this group concluded that such a statewide network was indeed technically feasible and economically justified. In early 1986, the Indiana General Assembly enacted a statute that created the INTELENET Commission.

The INTELENET RFP was released in March 1986. Proposals were received in June and the contractor was selected in October. February 6, 1987 was a significant milestone as the INTELENET Commission and GTE Telecom, Inc. (GTETI) signed a contract. Network cutover was begun in March 1988 only one year after construction was initiated!

Defining requirements and feasibility study

The first steps toward INTELENET had the following purposes:

1. To collect and analyze data in enough detail to accurately compare communication capabilities and cost of INTELENET to those of existing systems
2. To provide traffic data necessary to estimate the cost of INTELENET
3. To provide requirements data for the procurement process.

As a result, several scenarios were offered in the feasibility report:

1. Current video, voice, and data requirements
2. Option 1 (above) plus additional video channels
3. Option 2 (above) plus 10% annual growth
4. Phase 1 (defined below)
5. Phase 2 (defined below)
6. Phase 3 (defined below)

Phase 1 includes all existing applications:

1. State-wide voice network
2. Existing data applications
3. IHETS broadcast video network

and the following locations to be served:

1. Universities
2. County seats
3. Locations served by long distance voice provided by state government's Capitol Centrex
4. Other locations with sufficient traffic.

Phase 2 includes applications requiring significant new development and funding:

1. Origination of video programming from other than higher education (IHETS)
2. State library and information database
3. Electronic document delivery system

and the following locations to be served:

1. Phase 1 locations
2. Most libraries
3. Major school corporations
4. Most law enforcement
5. Other locations with sufficient traffic.

Phase 3 includes applications, e.g. two-way video, that are dependent on advances in technology, user capabilities, and funding.

Government legislation

IC 5-21 defines the composition of the INTELENET Commission and grants it authority to:

1. Borrow money
2. Contract for a 5-year lease for services
3. Negotiate authorized user service agreements

Also, IC 5-21 specifically prohibits the Commission from owning the network!

Procurement

The steps in the procurement process included:

1. Preparing a request for proposal (RFP)
2. Evaluating the proposals
3. Selecting the contractor.

The RFP stipulated that the network would be owned and managed by the successful bidder. It specified a five-year lease that required no capital investment by the INTELENET Commission. '. specified only inter-city services and requested pricing at both the option 1 and 2 levels described above in the feasibility scenarios.

Information included in the RFP included:

1. Switching hub location(s)
2. Concentration site locations
3. Voice, data, and video channel requirements at each site
4. Interfaces to be supported
5. Performance and availability requirements
6. Network management requirements
7. Contractual obligations.

These contractual obligations included:

1. Period of performance/Term of contract
   a. Acceptance procedures
   b. Conditions for termination
   c. Extensions of time
2. Equipment installation and usage
   a. Equipment site preparation
   b. Engineering changes

3. Maintenance
   a. Maintenance availability
   b. Spare parts availability
   c. Maintenance standards
   d. Service interruption credit

Evaluating the proposals was based on the following factors:

1. Technical specifications (30%)
2. Quality of proposed approach (40%)
   a. Soundness of technical approach
   b. Implementation planning
   c. Vendor qualifications
   d. Ratepayer impact
3. Price (30%)

Implementation

Implementation requires the following to insure success in schedule, budget, and operations:

1. Detailed planning that is reviewed and updated weekly
2. Detailed scheduling of resources that is reviewed and updated at least weekly and in the initial stages, on a daily basis
3. Detailed coordination of construction, procurement, installation, test, and cutover
4. Regular and persistent communication between the contractor and the customer to identify and to resolve problems as a team
5. Weekly meetings to check status toward network conversion
6. Weekly meetings to plan and to execute network cutover
7. Strict budgeting and accounting of manpower, time, and financial resources
8. Constant review of budget vs. requirements.

Management

Pricing network services

The INTELENET Commission has established the following guidelines for pricing INTELENET services:

1. The INTELENET pricing policy should maximize the Commission's flexibility to make future pricing decisions.

2. The INTELENET pricing policy should encourage wider utilization of its service.

3. The goal of a pricing policy should be to lower prices (rates) for all users in order to utilize the growth capacity as rapidly as possible.

4. Annual revenue should be sufficient to cover long-range operating costs, including administrative costs.

5. The INTELENET pricing policy should include the distribution of administrative costs across all users of the service.

Following these guidelines, the Commission has adopted the following pricing strategy:

The Commission employs discounted tariff rate pricing which offers a discount, from the prevailing tariff (where available) of common carriers, sufficient in the aggregate to recover the costs of providing the service according to IC 5-21-5-1(b).

Where a service has no prevailing tariff to use as the baseline for discounting, the aggregate revenue generated by that service must be sufficient to recover the costs of providing the service according to IC 5-21-5-1(b).

Marketing network services

When an authorized user decides to use INTELENET services, the Commission and that user negotiate a customer service agreement that contains the following:

A. Definitions

B. Duties of INTELENET

C. Term of agreement

D. Consideration
  1. When charges begin and customer pays
  2. Pricing services
  3. Installation fees
  4. Billing invoice
  5. Minimum purchase quantity

E. Installation and acceptance

F. Maintenance

G. Cancellation or termination

WHY IS INTELENET A ROLE MODEL FOR THE NATION?

At this time, INTELENET is still unfortunately unique! What makes INTELENET unique?

INTELENET is comprehensive! INTELENET serves an entire state. While other states have state-wide networks, no other state-wide network offers the wide range of services offered by INTELENET:

1. Broadcast video at DS-3 (45 Mbps) rates
2. Data services at a wide range (from 1200 bps to 1.544 Mbps) of rates
3. Voice service.

Other public service networks that may offer similarly broad services do not cover an entire state.

The INTELENET Commission is special! The Commission represents a coalition of state government and education that works in Indiana. IHETS creates the critical mass of communication bandwidth demand that generates the economies of scale to be enjoyed by all of Indiana government and education. State government has created the Commission to capitalize on this opportunity!

REFERENCES

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   1 North Capitol, suite 310
   Indianapolis, IN 46204
   317/232-4978
   Bitnet: TOMHO@ PURCCVM

2. IHETS Report for 1985-86. Available from:

   Indiana Higher Education Telecommunication System
   957 West Michigan Street
   Indianapolis, IN 46223
   317/263-8900

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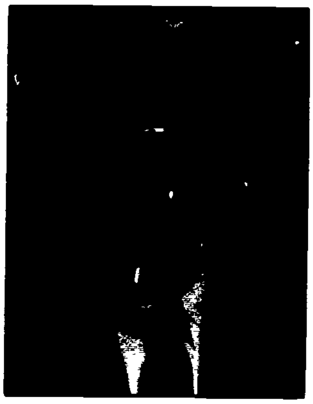
Track VIII
Academic Computing Strategy



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Many colleges and universities are increasing investments in computing for instruction and research, but few have planning processes that link such computing to institutional strategy. Are such processes necessary? Moreover, does more or better computing lead to fulfillment of institutional—as opposed to technical—goals? Papers in this track address such questions.

Douglas E. Hurley, University of Kentucky

Paul J. Plourde, Bentley College

ACHIEVING INSTITUTION-WIDE COMPUTER FLUENCY: A FIVE-YEAR RETROSPECTIVE

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The papers reviews the efforts of Bentley College over a five-year period (1983-1988) to integrate the use of computers into virtually every phase of academic life. It chronicles the noteworthy events that were planned and executed that had as their main objective the movement of the student and faculty population beyond computer literacy and to achieve computer fluency.

Some of the events that are reviewed include developing and implementing:

training seminars for faculty,

strategies for integrating the computer into the curriculum,

a strategy for equipping all students with microcomputers and associated software,

a campus-wide data and tele-communications network, and an on-line library system.

The paper concludes with an assessment of the successes and failures of the various strategies employed to accomplish our academic computing goals.

In 1977, Bentley College started what has since become a long involvement with the use of computers to support its instructional program, as well as, automate the administrative and academic support mechanisms of the college. As an institution primarily oriented to students (8,000 FTE) who major in business related disciplines, the college first reacted to the burgeoning presence of computers by a creating a new department. This department Computer Information Systems (CIS) was established to teach service courses for other academic departments and to teach specialized courses to students whom they hoped to attract to major in this discipline.

By 1983, the strategy of introducing a major in Computer Information Systems and the related strategy of first teaching service courses and then beginning to integrate the use of the computer in the other disciplines had been more fruitful than we could have imagined. By this time, we had attracted nearly 1,000 majors and the twenty-five full-time faculty members were teaching over one-hundred sections of CIS courses.

Another strategy was to teach computing skills to our own faculty by offering computing seminars. These were introduced by Academic Computer Services to introduce non-CIS faculty to the fundamentals of computing and the prospects of using computers in their respective disciplines. 1 The carrot that was used to attract faculty to these seminars was that they would be assigned a computer or terminal at the completion of the training period. The result was that over one-hundred of the one-hundred and seventy (170) faculty at that time participated. A few faculty went beyond these offerings and audited specialized CIS courses and still others enrolled as students in the Masters program in CIS. These efforts, resulted in a modest number of non-CIS courses approximately thirty (30) that required the student to complete some computer related assignment.

Up to this point in time, the primary hardware support was several hundred time-sharing terminals attached first to a large DEC10 system and subsequently several PRIME systems. This was supplemented by a micro laboratory equipped with forty-one (41) APPLEII+ microcomputers. Of more importance is the fact students paid a lab fee for the use of these facilities that was based on the extent of use that was anticipated in a given course. When the course was completed, the student did not have access to computing facilities unless they registered for another course that required the use of the computer or they took the initiative to voluntarily pay a computer lab fee. It is not surprising that this has been categorized as

> "COURSE-ORIENTED COMPUTING .... The main characteristic of this phase of computer utilization was that course assignments dictated the use of the computer. Students were spoon-fed assignments in a particular course and they were not necessarily encouraged to utilize the system(s) after the course was completed." 2

This brief review of the pre-1983 computing era sets the stage for a discussion of the topic of this paper which is the Five-Year period after 1983 when Bentley sought to achieve institution-wide computer fluency.

The objective of this period was to proceed beyond computer literacy, which we defined as "an awareness and knowledge of the hardware and software as well as directed use," 3 to achieve computer fluency which involves the understanding of how to utilize the hardware and software to solve business problems and developing experience doing just that.

The view at Bentley was that

> "in an information society, individuals will not be force-fed in the business environment as they were during Phase I. Our hypothesis is that the user determines when a computer is needed to solve a business problem." 4

In order to accomplish this redefined objective, we literally had to change most everything we were presently doing as regards computing at the college. This ranged from how instruction was provided to how students gained access to computing facilities and included developing a program for increased faculty involvement in terms of increasing the integration of the use of computers across the curriculum and extended to revamping the organizational structure of computer services. The first step towards affirming that we were aspiring to this new goal was the publication by the Dean of the Undergraduate College in 1983 of a set of ambitious academic computing goals as follows:

"1. All Bentley College Bachelor of Science and Master degree degree candidates will be computer literate.

2. The Computer Informations Systems Department will offer programs in information systems and computer science that are nationally recognized for the expertise of their graduates.

3. Computer applications will be integrated across the curriculum in appropriate disciplines and courses so that individuals in majors from departments other than CIS will be at the forefront of computer applications in their fields and will be sought by employers for this characteristic.

4. The college will offer credit and non-credit computer programs as appropriate for such audiences as executives, high school teachers, children, small business people and others seeking a level of computer knowledge.

5. All Bentley faculty will be computer literate and be able to employ the computer in their courses, where appropriate, within four years.

6. Relevant faculty research will be supported on campus or through time-sharing off campus.

7. The college will support a computing utility that includes mainframes as well as various microcomputers with stand-alone and on-line mainframe access capability.

8. The college will provide for the sale of microcomputers to faculty, staff, and students." 5

These were indeed lofty objectives and the strategies that were used will be reviewed below, as well, as an appraisal of the relative measure of success and/or failure of these various strategies.

First of all, we had to examine the organization that existed to support academic computing. In 1983, the Director of the Computer Center (who controlled the hardware and software resources) reported to the Vice President for Administration and the Director of Academic Computing reported to the Dean of the Undergraduate College. There was an advisory committee on computing comprised of members of the Board of Trustees sprinkled with a few select external members but the real decisions were made by the Board of Trustees Committee on Business and Finance who acted on resource allocation requests to acquire hardware and software as well as fund new positions.

Organizationally, the first action was to bring the Director of Academic Computing under the Director of Computer Services but, almost simultaneously, the Board of Trustees approved the creation of a new position of Vice President for Information Services which would carry with it the creation of a Board of Trustees Committee on Information Services. This action was significant in that discussions on planning for and the use of information technology would have its own forum at the board level with chairman of this committee serving on the Executive Committee of the Board of Trustees. Previously, such discussions were minor items on a long agenda before the Committee on Business and Finance.

In practice, the recommendations of the Information Services Committee do come before the Business and Finance Committee when funds are required but the added benefit has been that the Committee on Academic Affairs has been brought into the deliberations when computing issues impinge on academic policy which is often the case. In fact, there have been a number of joint meetings of the Board of Trustees Committees on Academic Affairs and Information Services.

The next area of major concern was how we would transition from the course-oriented computing environment described above to a student-oriented computing environment where

> "the computer is merely a another version of the "MIT slide-rule"and that, if they are properly trained, the students will decide in a judicious manner when the computer should be used to solve a problem in whatever course." 6

The impact of this approach on the faculty is significant since, if successful, it would allow the faculty to assume that the student had knowledge of a variety of software tools and approaches as well as hardware. Thus, when a problem presents itself, the student will determine whether this problem-solving exercise is suited to computer use and seek out appropriate hardware and software with which they are familiar or seek help from faculty or student cohorts.

In order to achieve this new environment, we planned to expose freshmen to six courses in which they would make extensive use of computer. This was begun in 1984 with all freshmen were required to take two courses in Computer Information Systems and a select group of one-hundred and fifteen freshmen participated in a pilot test in which they were required to take a two-course sequence in accounting and a two-course sequence in english and made extensive use of the computer.

The students in this pilot study were equipped with portable/ personal computers and software which included BASIC, LOTUS, a word processing and an integrated accounting package. The other students, who were only taking the two course CIS sequence, had to use the computer labs for completion of class assignments. Thus, it is not surprising that the pilot study sought to determine whether a portable computer used by students, wherever and whenever they pleased, would be a better vehicle to implement student-oriented learning than a desk-top computer used by students in a campus computer laboratory.

Analysis of a pre-test and post-test instrument resulted in a positive reading of the impact of students having computers and in 1985-1986 all freshmen were equipped with portable computers and in the academic year 1986-1987 all freshmen and sophomores were equipped with similar computers.

The attitudes of the pilot group towards computers and computing as a tool indicated that experimental group students had positive attitudes toward computers and computing at the beginning of the experiment and the post-test revealed that their attitudes became even more positive toward:

...computers improving the quality of life.
...word processing being of use while at college.
...their power over the computer.
...computers as easier and less complicated.
...writing is more exciting. 7

The positive findings on attitudes toward computers and computing reinforced the goal of issuing portable computers for all students. The non-negative effect on writing along with the singular result that writing was perceived as more exciting also reinforced the model and method for delivering the model.

During 1984 and 1985, we intensified the faculty computer workshops which ranged from specialized half-day and multi-day sessions for faculty that had already achieved basic computer literacy to a full week of training during the summer and in January for new and old faculty who needed the basics. We also altered the courses that the we anticipated freshmen would make use of computers extensively by adding a quantitative analysis course and the an economics course to replace one of the accounting courses that was moved to the sophomore year.

In preparation for the pilot test and the full implementation of the required computer program, we had an active implementation committee of faculty and a few administrators who planned course content, the timing of the introduction of material as well as more mundane and essential matters as the logistics of distributing hardware and software and introducing the students to the system before the first of classes. The particulars concerning these activities were reported at CAUSE 85 and appear in the proceedings.**

The lack of such a committee proved to be a problem in subsequent years in terms of course coordination although the distribution of the equipment became a routine success.

As we moved onto our second year of requiring micros, we continued to expose students extensively in the freshmen but the development of courses in the sophomore year lagged behind our expectations. It is important to note at this juncture that our strategy from the beginning was to train faculty and start with course development in the freshman year and then the sophomore year and finally penetrate the upper division courses. To be sure, there were selected non-CIS faculty who had the inclination and/or the ability to develop courseware or simply utilize existing software in upper-division courses. There was a very practical reason for this bottom-up strategy since we hoped to justify the further expansion of the required computer policy in subsequent years and we needed to insure that students would find a need for the equipment.

Throughout this program of requiring freshmen and sophomores to rent computers, we continued to administer the pre and post test instruments that we had used in the pilot test. After evaluating the cost and benefits the college decided not to expand the program beyond the freshmen and sophomore years and, in 1987, juniors, and seniors were merely encouraged to acquire a computer while the freshmen and sophomores were still required to rent or buy a computer.

The implementation of this policy resulted in the sale of 141 (15%) computers to Juniors in the fall of 1987 and only a handful of Seniors chose to acquire a system. It is important to note that only the pilot test group amongst these Seniors had access to a computer during their Freshmen or Sophomore years. Of those students who majored in Computer Information Systems, 30 percent acquired computers as Juniors and 70 percent did not. Only 20 percent of these same CIS majors acquired computers in 1988 as Seniors.

The situation improved somewhat in 1988 when 25 percent of the Junior class chose to rent or buy a system but 57.1% of CIS majors chose this option. A review of the reasons identified by upper division students for acquiring or not acquiring a system is noted below and they reflect the very practical nature of the Bentley student especially when one considers that over 75% of them work extensively to support their own college education. Thus, it is not surprising that cost, need, and convenience were of primary concern.

REASONS FOR ACQUIRING	
Needed in a course	27.5%
Convenience	27.5%
Cost/Benefit	20.7%
Word Processing	13.7%
Dislike labs	5.9%
Other	8.7%

REASONS FOR NOT ACQUIRING	
Cost too high	41.3%
Have micro access	17.4%
Not needed	13.0%
Obsolescence	10.8%
Labs are better	6.9%
Poor quality pc	4.3%
Other	7.3%

Utilization of computers in courses has not increases as we had expected and integration of computer use across the curriculum has not proceeded as swiftly as we had anticipated. Of some import is an apparent rejection of the notion that once trained students will decide for themselves to solve business problems with computer tools that they have been trained to use. There is little evidence

of any significant use of computers beyond the original exposure to word processing, spreadsheeting and some statistical analysis unless it is course-directed. In fact, students do not use computers significantly more as Juniors and Seniors. To the contrary, use diminishes in the senior year.

While the preceding could be viewed as a failure of the original program, in a very real sense it could also be viewed as a reaffirmation of our original policy that students should decide wherever and whenever they should use a computer. In reality, the extent of use is masked somewhat by the elimination of computer fees associated with courses. Instead students, who have not rented or purchased a computer, now pay a computer lab fee. Thus, we no longer keep a rigorous count of courses and registrations in these courses since it does not computer fee revenue.

This lack of expansion in the number of courses was not the only or most major problem that resulted in subsequent years however. Of more import was a major new thrust by the institution that had the effect of invalidating the academic computing goals that were advanced in 1983. This event was the new commitment on the part of the institution to emphasize research on a co-equal basis with teaching. The impact of this change was that faculty no longer felt compelled to the previous high priority on faculty computer fluency and the integration of the computer in courses across the curriculum.

Paralleling these activities on the academic front were five other projects that had a major impact on moving the institution towards the level of fluency that we sought to achieve. These were:

1. the acquisition of an integrated MIS package and the subsequent decision to modify the package,

2. the development of a campus-wide local area network which was reported at the CAUSE National Conference in 1985, 8

3. the installation of a digital telephone system,

4. the acquisition of a library package, and

5. the extensive use of micros in administration and in virtually every facet of college life.

With all of this activity, it is important to consider where we are today and where we might direct our attention to in the future. The following is a list of the more notable points of fact concerning computing at Bentley.

--Computers are mandatory in the freshmen and sophomore years.

--Computers are optional in the junior and senior years

--students do not use computers significantly more in the upper division

--students have not embraced our concept of having computers at their disposal to solve business problems

--integration of the use of computers across the curriculum is fairly stagnant although task forces are addressing this

--the LAN has not been extended to student rooms

--the administration uses an MIS package but they are looking to the SQL software generation

--their is extensive use of micros in all facets of administration (academic as well as administrative)

--the library package has been in use for three years but there is not extensive remote access

--the digital telephone system installed three years ago has not been used extensively for data communications

As far as looking at our future, most of the following will likely occur:

--Mandatory computers for Freshmen and Sophomores will continue for a few more years

--There will be a slow increase in course utilization

--there will be some renewed interest in mainframe computing

--there will be a major increase in student demand for network access to PC's, the library, records and external sources

--there will be increased distribution of the administrative computing workload

--there will be continued expansion in the use of micros of various types in all facets of college life with a gradual demand for connectivity

--the LAN will be extended to student rooms but the LAN vs PBX issue will not be resolved quickly.

FOOTNOTES

1 For the contents of these training sessions, see the Proceedings of the ACM Conference on Computer Science Education, D.Anderson and H. Zbyzinski "Faculty Training Seminars," Philadelphia,PA, 1984 pp. 210-219.

2 James Adair, Dennis M. Anderson and Paul J. Plourde, "Transitioning from Computer Literacy to Computer Fluency," Proceedings of the International Busineess Schools Computer Users Group (IBSCUG), University of Iowa, July 29,1986 pp.29-40.

3 IBID., p.31.

4 IBId., p.32.

5 IBID., p.39.

6 James Adair, Dennis M. Anderson and Paul J. Plourde, "An Experiment in Student Oriented Computing," in Computers and Business Schools: Progress on Integration, Green, R., Malhotra, N. and Parsons, C. Georgia Institute of Technology: Atlanta,GA, July 29, 1985, pp. 76-97.

7 James Adair, Dennis M. Anderson and Paul J. Plourde, "Organizing and Implementing the Freshmen Computer Program," in Proceedings of the National Educational Computing Conference (NECC86), W. Ryan (ed.), ICCE:Eugene,OR, pp.107 -111.

8 Plourde, Paul J. "Organizing to Suuport the Masses: A Unified Approach," in Proceedings of CAUSE85. Planning and Managing the Odyssey, CAUSE:Boulder,CO, December 1985, pp.343-353.

9 Plourde, Paul J. "Developing A Campus-Wide LAN: We're Half -Way There," in Proceedings of CAUSE85, Planning and Managing the Odyssey, CAUSE:Boulder,CO, December 1985, pp.211-221.

A METHODOLOGY AND A POLICY FOR BUILDING AND IMPLEMENTING A STRATEGIC COMPUTER PLAN

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ABSTRACT

The University of Akron's computing was under the control of the computing center from 1964 through 1980. All planning and implementation of computing hardware and software was controlled by the Computer Center. In 1980, with the implementation of Personal Computers, this centralized control was no longer the accepted norm. Starting in 1984, the state supplemented the University's computing dollars to the tune of $3 million for each biannum over a six year period. This additional expenditure of $9 million had a stimulating effect over the distribution of computing across campus. It pointed to the need for a strategic computing plan for the entire campus.

In December of 1985, the President requested that I put together a computer planning committee and complete the plan within three months. The outcome of this request produced a Computer Planning and Policy Committee and several subcommittees to do the actual planning. This paper will discuss the approach on how we view computing as it fits into the strategic plan. A policy for controlling the acquisition of all computer software and hardware will be discussed. This policy was developed to make certain the plan is implemented with little or no duplication.

A METHODOLOGY AND A POLICY FOR BUILDING AND IMPLEMENTING A STRATEGIC COMPUTER PLAN

Introduction

The University of Akron is an urban university with seven colleges; Fine Arts, Education, Arts and Sciences, Engineering, Business, Nursing, and a Community and Technical two year college. The University has been fortunate in that the central computing resources during the 1960's and 70's were adequately supported and staffed. We do not have many departmental computers although there are two academic mini's outside the computer center. That is to say the demand for departmental computing, due to the lack of a good service in the central center, has not led to the decentralization of computer resources. However, in 1980 when personal computers began to appear, the situation changed. Budget requests for personal computers were submitted from every department. The central computer center was no longer the single source for this valuable resource.

From 1980 to 1984 most of the budget requests were not being funded by the central administration. There was not enough monies to satisfy all the demands.

At the same time, the Directors of Computing from all the Ohio universities were working with the Board of Regents to obtain additional monies earmarked for academic computing. This additional money was proposed to supplement the universities' operating funds and allow us to purchase additional academic software and hardware--especially personal computers.

These additional funds were approved by the legislation in 1984 and were allocated on a formula based on the need for work stations. The University of Akron's allocation was $3 million for each biannum, starting and ending in 1988 for a total of $9 million. The first $3 million was allocated to academic departments. Within one year, these monies were spent for personal computers and replacement equipment.

During the 1984-85 academic year, the administration was overwhelmed with requests for computer equipment. It was evident that to spend $3 million dollars in an effective manner, we needed an overall plan for computing. This paper will discuss an approach to building a strategic plan and the policy that supports the implementation.

How do things happen?

Things happen because you make them happen and finding the time to make things happen is the problem. On one hand there is never enough time to plan, yet, on the other hand, there will never be enough time available for doing more things until you plan. Doctors Merrill Douglass and Larry Baker commented in their Time Management Program Guide, "The more you do of what you are doing, the more you get of what you got." Planning does not start

with strategic planning; it starts with daily planning of your activities to meet your objectives. Once you master planning at all stages, it becomes a habit. It is with this type of habit that I relate to you the focus on strategic planning for computing at the University of Akron.

Before 1980, the planning for computing was the total responsibility of the Computer Center. During the 1970's this was not all bad as batch processing tended to centralize computing. Today, with personal computers and local area networks, the ability to distribute computing has the advantage of allowing the user to control his own destiny and not be at the total mercy of one organization.

Why a Strategic Computing Plan?

When computing was centralized, the entire request for computer resources came from the computer center. In one way, this was good for the administration in that computing resources were controlled. As personal computers came into the picture and every department and college was asking for computing dollars, the administration had to have a plan to control the request for computing resources. A strategic plan would help the institution to also meet its goals for better quality in its efforts to upgrade instruction as well as its research capacity.

A third reason to support such a plan was to make certain that each and every faculty member and student had access to the resources they required to do their job.

A Need for a Strategy

It was with these goals in mind that the President, Dr. William Muse, in January of 1986, asked the Computer Center Director to put together a strategic plan and requested that I help form and recommend members for a computer planning committee. Since the scope of the job was too big for one committee, I recommended we have a Computer Planning and Policy Committee and that sub-committees be formed to do the actual planning.

A Computer Planning and Policy Committee was recommended to the President with the objective to define the scope of the plan and review the plan for funding. This committee consisted of the Provost, Vice President of Business and Finance, Director of Computer Services, Assistant Director of Computing for Administrative Systems, one dean, three faculty members and the university Controller.

The Computer Planning and Policy Committee met and decided that one, the University's view of computing was consistent with the state of the art, and secondly, that every faculty member and student should be able to access the necessary resources he required through the appropriate network.

Keeping in mind that there is no longer a centralized view of computing and that the University wants to increase its quality and quantity of computing for instruction and research, I formulated an

approach to develop a strategy. I took the view that computing exists at various levels and in special categories. For example, there is administrative computing; hence, we need a strategic plan in that category. We also support a Computer Based Education Center and we have a definite need for a plan here. Office automation is another special area and we wanted to make sure that we built a plan to increase our productivity in this area.

For academic's, computing exists at various levels and is distributed. We broke academic computing into three areas--large mainframes, graphics (a special area) and minis and micros. The concept here is that we want any student or faculty member to be able to access any mainframe through any network. Since networking is so important to our plan, the final area to be considered was networking.

The strategy was to break computing into various areas of specialization and three levels for academic computing through a hierarchical network of micros, minis and large mainframes.

My suggestion to the Computer Planning and Policy Committee was to form seven subcommittees to do the actual planning. This recommendation was accepted. The special areas for planning were:

1. Administrative computing
2. Large mainframe academic computing
3. Academic minis and micros
4. Graphics, both academic and administrative
5. Computer Based Education, Instructional
6. Office automation for all departments, Deans, V.P.'s, etc.
7. Networking

Planning subcommittees were formed from appropriate members of the faculty, Faculty Committee for Computer Utilization, and administrators. Each subcommittee had five members including myself as an ex officio member. The members of these committees were the key players in their area of expertise from the faculty and staff. The President appointed each member after reviewing my recommendations. The subcommittees had two months to formulate the results of their studies into a detailed plan. The role of each subcommittee was to interview faculty and staff and compile the computing needs for their portion of the plan. Most of the subcommittees set up specific times and dates to meet with their constituents and many used surveys to reach those individuals that could not attend the subcommittee meetings. All the subcommittees completed their interviews and consolidated their data into a report within a week of the scheduled completion date which was March 1, 1986. It was then my responsibility to consolidate their data and complete a final draft of the plan by April 1, 1986.

Developing the Plan

The final plan was developed along the same lines as the subcommittees with six separate sections. Each recommendation was itemized with an estimated cost. The Computer Planning and Policy Committee reviewed the plan and made selected cuts where they felt it was over estimated in quantity or duplication. The total cost of the plan was estimated at $13,124,200 and cut to $12,067,500.

Large Academic Mainframe

This committee recommended we purchase an IBM 3090-200 and an IBM 4381 to replace our IBM 30330 and the IBM 4361. The budget cost was approximately $6,387,000, we spent $6,450,000. This included the purchase of six IBM 3380 disk drives. The recommendation was adopted by the Computer Planning and Policy Committee and the equipment was acquired through a lease purchase in December of 1986.

Minis and Mic

There were 16 recommendations for a total cost of $1,605,000; approximately $355,000 has been spent to date. Several of the recommendations have not been implemented due to the fact that clusters of micros were to go into new buildings not yet completed. One of the recommendations had to do with one additional minicomputer for support of graphics.

Graphics

There were nine recommendations for a total cost of $1,975,500. To date, we have spent $430,000 on both academic and administrative graphics. There were recommendations for three dedicated graphic centers in Civil Engineering, Art and Construction Technology.

Administrative

The administrative plan was a continuation of our previous administrative plan with a total cost for additional software and hardware at $200,000. To date, we have spent $160,000. Most of the monies were to be spent in support of telephone registration, which was installed in October of 1987.

Computer Based Education

This portion of the plan recommended we do nothing and that no more money should be spend in updating software and hardware.

Office Automation

The subcommittee recommended that we install Sperry's Office System with a separate minicomputer network of Sperry 5000-50's and 5000-85's to support the President, Vice President, academic and administrative departments. Total cost for this effort was estimated at $1,400,000. To date, we have spent $400,000.

Networking

A general summary stated that we develop our own data network. We had recently purchased our own Dimension 2000 voice switch and access the existing cables on campus. The approximate budget was $100,000/year for fiber and twisted pair cables to be connected between buildings. To date, we have spend $350,000 that includes a Proteon backbone network between the Computer Center, Engineering, Computer Science and the Library. This Network allows us to reach the Supercomputer Center in Columbus, Ohio.

Summary of Expenditures to Date

	Budget	Expenditures
Large Academic Mainframe	6,387,000	6,450,000
Minis and Micros	1,605,000	355,000
Graphics	1,975,500	430,000
Administrative	200,000	160,000
Computer Based Education	0	0
Office Automation	1,400,000	400,000
Network	500,000	350,000
TOTAL	12,067,500	7,795,000

Updating the Plan

The plan was updated once in 1987 and the subcommittees were reinstated to review the plan and make the necessary changes. Today we are reviewing the graphics proposal and preparing a budget that will increase our expenditure in this area. We expect to complete the second review of the entire plan by June of 1989. Each subcommittee will be recalled to review the accomplishments and make the necessary request for changes.

Policy on Control of Hardware Acquisition

The Provost requested that a policy be written and approved by the Faculty Committee on Computer Utilization (FCCU) to govern the acquisition of all computer equipment. There already exists policies on computer and terminal acquisition and a new policy was written to govern the purchase of personal computers and local area networks in line with the five year plan. The basic policy states that the Director of Computer Services approves all the purchases of computer equipment.

Working with the deans and departments, the Director of Computer Services provided assistance in the selection of hardware and software to meet their needs. The policy on microcomputers also states that the University support sev specific vendors and maintenance is performed in-house. The policy approved by the FCCU and the Provost and is in effect today.

Conclusion

Although the expenditures have involved approximately $8,000,000 in three years, we are anticipating adding three large personal computer clusters to two new buildings that will not be completed until 1990. One additional cluster will be added to the dormitories in 1989. Although we may fall short of money to complete the plan by 1991, we have taken very important steps in setting our objectives and goals.

I can tell you that should we spend 75 percent or better on the estimated budget, we will have made a major expenditure. The University is very close to being at the state of the art in computing.

ALIGNING PLANNING, POLICY DEVELOPMENT AND INFORMATION SERVICES DELIVERY IN A SHARED GOVERNANCE ENVIRONMENT

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ABSTRACT

With the arrival of a new president in July 1987, Eastern Washington University began an intensive examination and evaluation of existing organizational structures and planning processes for the entire university with particular emphasis on computer services, both academic and administrative. In early 1988 major recommendations were presented and approved with respect to a number of areas. These included the definition and establishment of a university-wide planning/budgeting process, the creation of a University Computing Policy Review Committee, and the creation of a single University Information Resources division that includes a Chief Information Officer reporting directly to the president.

This paper briefly reviews the background problems and issues which led to these changes, presents detailed information on the processes and structures that have been established, and discusses the first year of implementation. Finally, the outlook for the future is explored.

I. BACKGROUND

Planning/policy making Processes Prior to July, 1987

Eastern Washington University had operated on a highly decentralized model for the ten years prior to 1987. The University was divided into three major areas of responsibility including Academic Affairs, Business and Finance, and Extended Programs. Each division was headed by a vice president reporting directly to the president. A fourth division was established in 1984 when a Vice President for Student Services was appointed and these services were centralized.

There were no formal entities charged with inter-divisional planning, and budgeting was viewed as individual to each organizational unit. An annual "roll-over" system of budgeting had been used at the division level and within departments in divisions. These roll-over amounts were occasionally modified to accommodate a general funding level change, or a new program which demanded new resources. There was no methodology in place for the periodic review of various programs to determine alignment with university mission or goals, and university direction suffered from the lack of consensus and widespread knowledge of university goals and directions.

The responsibility for computing services was divided between Business and Finance for administrative computing and Academic Affairs for academic computing support. Administrative computing was further divided between a computer center in physical plant which supported energy management and accounting services for the university's auxiliary enterprises, and the main administrative computing center. Administrative computing was fairly well provided for, with a fiscal year 1986 budget of over $3 million. Academic computing was less well provided for, with a fiscal year 1986 budget of $398,000. There was a total lack of university-wide planning for computer services, which was evidenced by empire building and the refusal to share resources between the academic and administrative factions.

Problem Statement

Many years of operating the university under the decentralized model led to a repetitive style of budget allocation within which budget bases were simply "rolled over" year after year with relatively minor adjustments applied except for reallocations necessary to fund new programs. As university role and mission changed over the years the contrast of mission to program mix as supported by the roll-over budgets became further and further misaligned. Further, the lack of sunset reviews in some cases caused the continuance of institutes and other special programs long after the purpose for which they had been designed had ceased to exist. The roll-over system also brought about inequities in the distribution of travel and goods and service budget allocations between units. This is most noticeable when a unit diminishes in staff due to attrition and non-replacement, but the budgets for travel and goods and services roll-over in tact because they are not tied to units of productivity.

The history of divided camps within the university's computing organizations resulted in a severe imbalance of spending between administrative and academic computing support activities. During fiscal year 1986 this gap had grown to the

difference between $55 per FTE for academic computing support and $313 per FTE for administrative computing support. The lack of computing plans and objectives made it difficult to determine whether or not funds were being properly expended, but a comparison of the funding levels requested from the Legislature against the actual spending showed that academic computing was spending approximately 23% of the funds requested and administrative computing was spending 110% of the requested funding. This meant that although the Legislature had not fully funded the requests for computing the institution was deciding to spend a disproportionate amount of the funding received on administrative pursuits.

Years of spending imbalances had left the faculty feeling disenfranchised with regard to computing on campus, and the student population poorly served in terms of access to university-provided computer services. Students using the computer facilities were charged annual fees averaging over $60 per student, yet as previously mentioned the spending per FTE was only $55. In addition to these problems, there were general difficulties with the lack of hardware and network standards that had come about due to the lack of overall planning, and problems with staffing patterns and the equal provision of support services to administrators in all divisions of the university.

II. THE PROCESS OF CHANGE

July 1987 - January 1988

Dr. Alexander Schilt was hired in the Spring of 1987 as University President, and planned to take office on August 1. One of the new president's first interests was to assess the planning/budgeting processes that existed at the university, which he did prior to officially taking charge. A consulting team lead by Dr. Thomas West, Associate Vice Chancellor - California State University System, and Dr. George Huxel, Vice Chancellor of the University Of Houston, came to campus to study planning, budgeting, and computer services. Among their recommendations for highest priority implementation were:

To Develop a university-wide planning/budgeting process that coincided with the State's biennial budget system.

To make a significant expenditure to provide improved student access to university computing

To create a single organization for delivery of all information services, including computing, telecommunications, printing and publications, and possibly the university library

To appoint a senior executive in charge of all university information resources reporting directly to the president

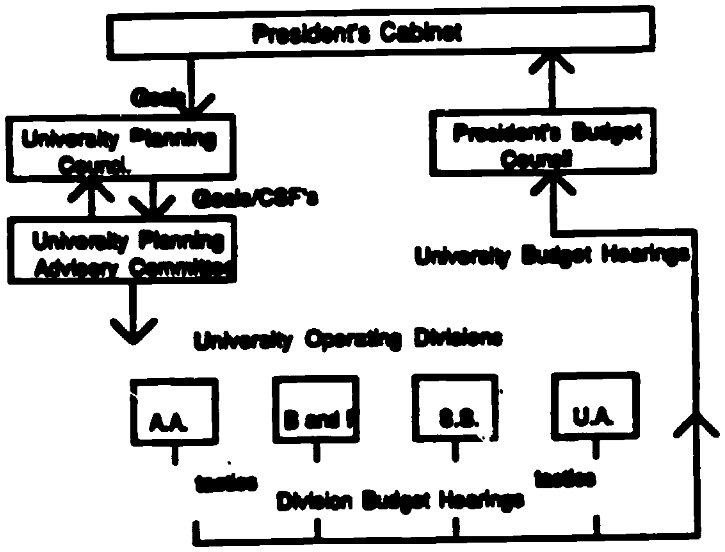
To establish a university-wide governance body for the formation and recommendation of computing plans and policies

The president accepted all of the recommendations of the consultant's, and formed a President's Select Committee to plan for the implementation of the recommendations. The university-wide computing governance group was established in January, 1988, and the University Informations Resources

reorganization was completed by March, 1988. The university-wide planning/budgeting process is just now getting under way.

Eastern's Direction and Model - University-wide Planning/Budgeting

There have been two layers of planning structure devised, one to accommodate strategic planning, the other to accommodate tactical planning. Input to guide the strategic planning process comes primarily from the University Role and Mission Statement, recent accreditation reports for the university and for several schools/colleges; a document created under the auspices of the Board of Trustees called "EWU 2000", and a report from a recent program review of all academic programs in the institution. Specific goal statements derived from these documents serve as the primary input for the planning/budgeting process. The organizational structure of the planning/budgeting process in as follows:



CSF = Critical Success Factor

The budgeting process will be composed of a combination of two components. The first component is a basic service level budget that is formula driven. Because the institution is funded by the State in accordance with a contract enrollment the formula component of the budget is enrollment driven. The budget includes only those ingredients that are deemed "absolutely" necessary to providing the basic services needed to generate the contract enrollment. Items such as institutes, faculty release time, enhanced systems, and other non-essential parts of the institution are part of the second budget component which is goal driven. As shown in the planning/budgeting organization above, once the goals and accompanying critical success factors are determined the organizational units take these and build budget requests that are supportive of the goals and critical success factors. These budget requests are subjected to two levels of hearing, one at the division level, and finally at the university level. It is the final combination of the two budgets (one formula driven and one goal driven) that forms the fiscal year operating budget.

Information Resources Governance - Trends in Higher Education

The organizational structure related to computing/information resources in higher education has undergone tremendous changes in the past 30 years. With the roots of computing in Computer Science Departments and business areas of the University much of the early attention focused on the combined versus separate issue with numerous studies and debates occurring. The current state of affairs is (as

noted in the 1980 and 1985 CAUSE Profiles) "in any given year a number of institutions are reorganizing the management of computing. At any point in time several combined installations are being reorganized into separate and several separate are being combined. Since there are good examples of both separate and combined organizations, it can no longer be said that any one organizational structure is better than another". However, as the capabilities of microcomputers continue to grow and the distribution of processing progresses to end users with more and more powerful tools, the traditional combined versus separate debate may no longer be appropriate.

Two emerging questions pertain to the reporting level of the person(s) responsible for Information Resources as well as their scope of responsibilities. As both academic and administrative computing have become more pervasive, the level of reporting for the individuals responsible for those tasks has been raised proportionally. The 1980 CAUSE Profile indicates that approximately 75% of those responsible for computing reported directly to a Vice President. This increased by 6% in the 1985 CAUSE Profile.

The second question, as noted by Gene Sharon in 1987, pertains to the scope of responsibilities for many of the "computer czars" on campus. Sharon notes that a 1987 study of 85 institutions identified Chief Information Officers, generally at the Assistant or Associate Vice President level, having comprehensive responsibility for academic and administrative computing as well as telecommunications. A recent edition of Information Resource Management predicts that by the 21st century the "CIO will be an integral part of the management team and will report at the same level as the Chief Operating Officer (COO) and Chief Financial Officer, and will report to the Chief Executive Officer (CEO)."

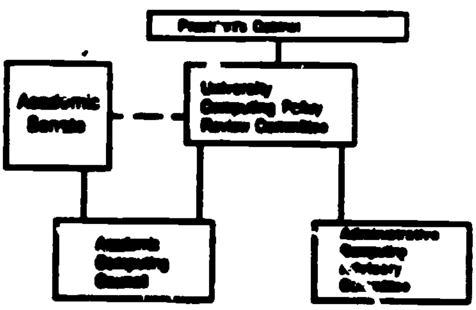
University-wide Computing Governance

A university-wide computing governance group called the "University Computing Policy Review Committee," constituted as shown below, was recommended by the consultants and approved by the Academic Senate and the President's Cabinet in the Fall of 1987. The primary charges for this group include:

Recommendations for resource allocations for all information resources

Recommendations for policies regarding the use and management of information resources

Recommendations regarding staff allocations and priorities for information resources departments



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The UCPRC serves as a recommending body to the Chief Information Officer, who in turn sits on the President's Cabinet. Recommenda' ›ns requiring Cabinet level approval or Academic Senate approval are carried to those bodies by the Chief Information Officer. Tasks that require action by one of the two computing subcommittees (academic and administrative computing) are coordinated with the UCPRC by the chairs of the subcommittees, who also sit on the UCPRC. An example of such a task is the policy statement describing the types of academic computing labs that will be established on campus (fully open, class labs, etc.) and the way in which those labs will be managed, staffed, and budgeted. This policy statement will be generated by the Academic Computing Council and taken to the Academic Senate by the Chair of that Council. After the Council and Senate are satisfied with the policy statement it will be taken to the UCPRC for acceptance. If changes are required the nature of the changes will be indicated to the Academic Computing Council, and the process will repeat until the policy is acceptable to the UCPRC. Because this policy will contain recommendations about budget bases the final recommendation will go to the President's Cabinet.

The university-wide planning process and the planning for computing futures which is done by the UCPRC must be complimentary. Of primary concern to the divisions when developing their goal based budget requests is that they perform careful requirements analyses, and accurately predict the resource requirements that are required by each budget request initiative. The UCPRC must then take all of the budget requests that involve information resources, and access the impact of these requests on the hardware, software, and staff resources of the university. In addition to putting together all of the division budget requests that involve computing, the UCPRC is charged with envisioning economies and efficiencies (making multiple uses of a single product, etc.) that may be realized through purchasing, staffing, or equipment usage innovations. Once the UCPRC has reviewed all of the information resources components of the goal based division budgets the recommendations of the group will be passed on to the budget hearings via the Chief Information Officer. Any resource allocations that involve the provision of computing or other information resources will result in the funding being placed into the Information Resources Division budget.

III. OUTCOMES

Institutional Strategic Planning

Accomplishments

The major accomplishment in the area of institutional strategic planning is the existence of the planning structure itself which held its first meeting in early November. In just over one year, President Schilt has put into place a detailed planning model as earlier described which includes the University Planning Council, the President's Budget Council, and the University Planning Advisory Council. On a project of this magnitude and scope, the impact and influence of institutional strategic planning is generally long range and requires what can be referred to as a "full cycle" before results can clearly be seen and evaluated.

Problems

As in any new venture, particularly one as comprehensive as the intended University planning process is, there are a number of traditional problems that can be anticipated. These range from the comfort of status quo; the trust of the

constituents groups; the need for clear, consistent and concise communication to, as well as from, the constituent groups. Finally, the patience of the University community is needed in permitting the process to go "full cycle" and produce results. While these do not represent unique problems or challenges for Eastern Washington University, they do represent the currently anticipated ones.

In addition to establishing a new planning process, the President has also in the past year assembled a nearly complete new team of senior administrators with only one of four senior administrators remaining from the the previous administration. Given the new Vice Presidents' need for familiarization and assimilation possible problems may be anticipated. The hope, however, is that the coincidence of a new planning process and a new senior administrative team can provide the opportunity, potential and impetus for progress. While the pace of that progress may be slowed due to the "newness" of the senior administrators, the possibility of success is excellent.

Future

With the planning process and nearly all of the key personnel in place, the future of institutional strategic planning appears very positive at Eastern Washington University. The state of Washington is currently entering its biennial legislative session with requests for the 1989/90 fiscal years being considered. The planning process as it begins will form the basis for allocating these funds. It will also begin long term planning to project University goals through the next three biennia. The initial "full cycle" of University planning will effect the biennial budgeting process for the 1991/92 biennium. A review process will be incorporated to roll the planning activity forward to retain a minimum seven-year long range plan.

University-wide Planning for Information Resources

Accomplishments

The University Computing Policy Review Committee represents the primary arm within the overall University planning structure for Information Resources planning and policy making. This group serves in an advisory capacity to the Chief Information Officer and is supported by two user committees - the Academic Computing Council and the Administrative Computing Advising Committee. Given the time line within which this structure was established, the most pressing issue was the development of plans and the submittal of materials associated with the 1989-90 biennial budget process. In addition to planning for the coming biennium, the user committees have focused on the initial organizational issues associated with their responsibilities and the allocation of existing resources in the current fiscal year. Significant progress has been made in all of the above areas as noted in the Implementation of Plans and Policies.

Problems

This structure represents the initial attempt at Eastern Washington University to strategically plan for both academic and administrative computing within a single organizational structure. While every effort has been made to minimize the traditional academic versus administrative issue; in reality, the interest, needs, and perspective of the representatives of these areas will vary greatly. One of the great

challenges is to adequately address the diverse needs of these groups within this structure.

One unresolved problem is the relationship of the University budgeting process and the Information Resources planning and policy process. The existing committee structure represents a somewhat convoluted process when related to the budgeting. Specifically, unit representatives in the computing planning and policy process are not in the same structure and alignment as the budget preparation process. This represents one of the major issues to resolve in the coming year.

An additional problem encountered in establishing Information Resource policy and planning is the absence of a long range strategic plan. Much of the efforts of the current committee structure as noted has been short term in nature and/or related to current issues and existing resources. The initiation and on-going planning process should greatly assist in resolving this problem and providing direction for the future.

Finally, the institution has recently expanded the number of major administrative systems as well as academic computing access. The procedures and structure for user input into the Academic Computing Council and the Administrative Computing Advising Committee should also be addressed in the coming year.

Future

With nearly one full year of activity completed, the initiation and operational aspects of the committees appear to be progressing well. A number of major projects and activities have been successfully completed through the existing committee structure. While some amount of functional "fine tuning" remains, the overriding need is for the University planning process to become functional and for that process to provide direction. With a long range strategic planning process for the institution, it appears reasonable that the structure established for Information Resources planning and policies is capable of developing plans and policies at the appropriate level.

<u>Implementation of Plans and Policies</u>

Accomplishments

As noted earlier the major foci in planning for the past year has been the preparation of materials for the biennial budgeting process, the allocation of existing resources, and the ever present organizational issues associated with a new committee structure. Regarding the biennial process, a planning retreat with representatives of the University community as well as the committee structure was held in early March for the purpose of establishing overall University goals for the next biennium. Four major priorities emerged from that retreat including:

1. Academic and administrative workstations

2. Campus networking

3. Library automation and expansion

4. "Other" University projects

The initial two priorities, (workstations and network), were assigned to small task force gr ɔs to develop general material for inclusion in the budget process. The library expansion project was to be considered by the senior administration. Finally, the "other" project category was referred to the administrative and academic computing committees for development.

General plans were developed for networks and workstations and included in the planning process for the University in developing its biennial budget. One of the major accomplishments of the past year has been a commitment to expand and upgrade the library capabilities at Eastern Washington University in a joint cooperative venture with Washington State University. Detailed implementation of this agreement is currently underway. The two committees addressed the "other" aspect of the biennial process projects. Much of the committees' planning and detailed activity that has occurred has related to this objective. The current activity of the committees is focused on developing priorities among the projects in this category and prioritizing activities among the workstation, network, and other project categories.

Both the academic and administrative computing committees also addressed the allocation of existing resources. Specifically, the Academic Computing Council dealt with the distribution of $378,000 for equipment allocated from the previous fiscal year as well as approving $175,000 of incentive grants for faculty members. Based on these two allocations together with other growth through colleges and departments, the number of academic workstations increased by approximately 43% between June 1987 and September 1988.

Allocating additional access to the administrative systems was a major task for the Administrati Computing Advisory Committee. An extensive review and priority process was established and additional access was provided to a number of administrative offices, all of which were functional by late October of the current year.

Problems

One of the major problems associated with implementation is the ever familiar limited resources and staff issues. Conceding that one might reasonably guess that sufficient resources and staff will never come to pass, a significant amount of progress has been made. As computing access for academia has expanded dramatically in the past year and the administration has implemented new systems (including Information Associate's Alumni Development System and Purchasing module) the need for networking for all users has become more and more apparent.

Another problem noted which appears to have been addressed was the lack of committee functionality over the Summer months. As a committee that now deals comprehensively with Information Resources, the availability of faculty in Summer becomes a more pressing issue, particularly, in the area of preparation of plans and policies.

Future

The implementation of the university-wide computing planning process provides the promise that the committees will have both direction and substance with which to deal. The implementation task of the committees in the coming year include prioritizing University wide requests for the biennium, final recommending action

once funding levels are determined, projects associated with long and short range planning process, and the development of a detail network plan for the institution. In addition, the initial task force recommendations which established the committee structure call for the committee to review and establish a permanent structure for the management and functioning of Information Resources. The process of establishing a permanent structure, prioritizing plans, and distributing funds for the coming biennium are goals which given the progress and accomplishments within the past year appear to be feasible.

Goals for the 1990'S

It is highly unlikely that the identified needs of the 1989-90 biennium will receive full funding and implementation. Therefore, many of the goals that have been established for the next biennium will continue into the early 1990's. Furthermore, as noted in the strategic planning section above, the most visible results of the newly established planning process will occur in the first full cycle of that process which will be the 1991-1992 biennium. Finally given the traditional and necessary implementation time lines generally associated with Information Resources growth, many of the needs which are met with funding in the next two biennia (through 1992) will be in implementation phases well into the 90's.

The general goals of the 1990's are then fairly simple and straight forward. They include:

1. A stable and on-going planning process which includes a minimum of a seven-year long range plan as well as biennial review processes to insure currency to that planning process.

2. An organizational structure for Information Resources planning that serves to incorporate the strategic policies and plans of the institution to Information Resources as well as address the needs and interests of the varying constituent groups throughout the University.

Among the specific goals for Information Resources at Eastern Washington University in the 1990's are:

1. A comprehensive and capable telecommunication network affording academicians and administrators adequate access to the hardware, software, and staff needed to carry out their duties.

2. Expanded access and an expanded role of academic computing with appropriate incentive and corresponding resources to increase the classroom use.of computers throughout the curriculum.

3. A comprehensive and integrated administrative system which can support and assist in the efficient and effective use of University resources.

The existence of a comprehensive planning process, the establishment of an appropriate organizational structure for Information Resources, the functioning of the committees and the commitment of the staff supporting all of the above should contribute and serve Eastern Washington University well in the coming decade.

The Changing Role of the CIO: Establishing the InfraStructure Was the Easy Part

Pı sented at
CAUSE88

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THE CHANGING ROLE OF THE CIO: ESTABLISHING THE INFRASTRUCTURE WAS THE EASY PART

The days of the swashbuckling technological impresario are waning. Fiscal worries have now forced administrations to think about priorities and the risks associated with distorting them by placing too much emphasis on the amassing of technology. Computing has come under scrutiny because of concern over spiraling investments for capital equipment, staff, space, and operations (maintenance, software, supplies, utilities). Consequently, the focus of the Chief Information Officer's (CIO) role is shifting, from procurement and deployment, to communication and integration.

In the past, owing to naïveté regarding the potential impact of technology on traditional intra-institutional relationships, or being intimidated by the technology, some central administrations consigned their strategic planning responsibilities to the CIO. The CIO provided leadership as the institution positioned itself with respect to computational technology. However, the speed of acquisition and the boldness of choice of technology have strategic implications that reach beyond the computational milieu.

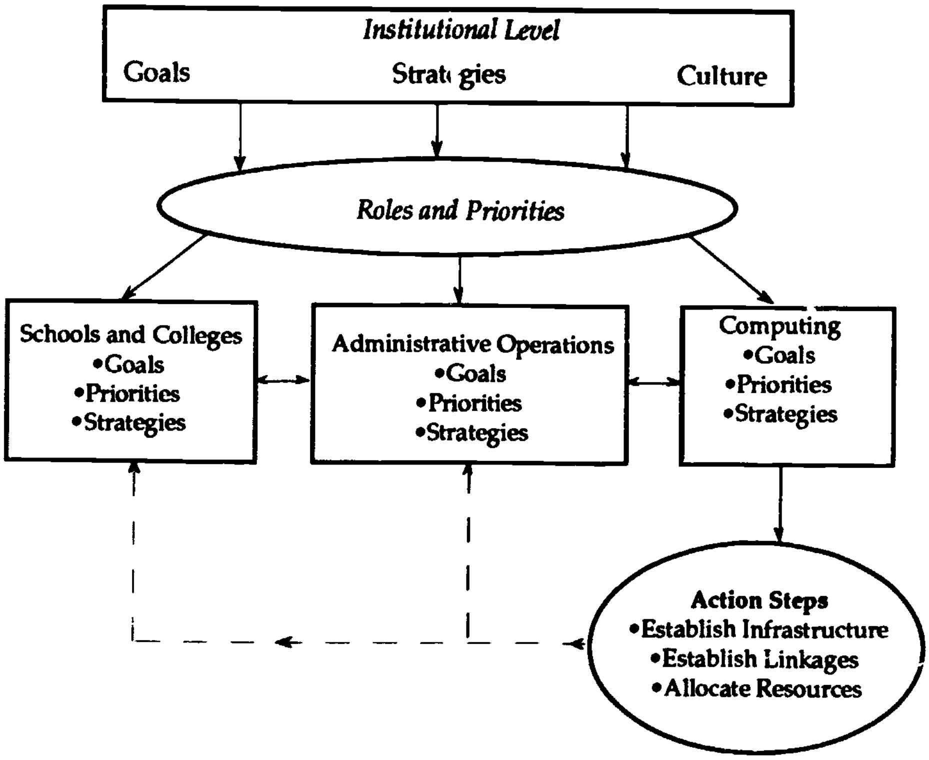
Some administrations have begun to assess the likelihood of the consequent technological environment's conforming to the institution's priority structure and cultural balance. Such anxieties are manifested in demands for evaluation and accountability, efforts to make direct linkages to academic and administrative goals, the emphasis on formal plans, and the mobility of CIO's. The time has come to refine and redefine the role of the CIO in relation to the composition, culture, and mission of the institution. Failure to engage in this form of introspection will lead to an unhappy mismatch between CIO and institution: a mismatch that has already occurred in more than a few instances.

A New Look at the Planning Process

Many institutions have by now set in motion plans that will lead to the establishment and maintenance of a solid infrastructure of computational technology and services. There has been a good deal of sorting and categorizing of equipment, much discussion of the components of computing infrastructure and its financing, but less of equitable deployment strategies and still less of prescriptions for making the linkage between computing and institutional goals. In retrospect, perhaps the most valuable outcome of the initial planning efforts has been the articulation of the strategic relationships, depicted in Figure I, that determine the role of computing (and, thus, of the CIO) within the institution.

Figure 1

Strategic Relationships



At Syracuse University those strategic relationships arise in the following form:

Institutional Goals:

- To be judged as the most improved and most rapidly improving independent institution in the AAU.
- To have our academic programs judged the most improved and most rapidly improving among independent institutions in the AAU.
- To maintain our comparative advantage and relative position in our administrative systems.
- To maintain the financial position of the University while financing the activities necessary to achieve these goals.[1]

Role of Computing: The shape of the computing environment will be a major factor in projecting the University to the next tier of academic excellence. The University aspires to provide high quality computing services, as needed, throughout its teaching and research programs while seeking opportunities to play a leading role in selected areas.[2]

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[1] Excerpted from Syracuse University Goals 1985-1990.

[2] Chancellor Melvin A. Eggers, Charge to the Academic Computing Planning Committee, 23 September 1985, Syracuse University, Syracuse, New York

Goal of Computing: To create a computing environment that strengthens the University's instructional and research programs...For computing to become as integral to instruction and learning as the library.[3]

Computing Strategy:

(1) Establish the infrastructure.
(2) "Make it all fit."

Another outcome of this initial planning exercise has been the definition of the role of the CIO and of the institution's expectations of that office. *EDUTECH* made the crucial distinctions in a two part series, appearing in its June and July 1988 issues, categorizing institutions and the roles of their CIO's into three groups: those that view technology as: (1) a strategic resource, (2) an aid in day-to day operations, (3) a source of confusion. The CIO (or equivalent) will be expected to function differently depending on the institution's sense of the importance of technology in achieving its mission as: (1) an information strategist, (2) custodian of machines and data, (3) technology problem solver.[4]

When implementing the initial plan, designed to create the computational environment, in an institution that has designated computing as a strategic resource and, thus, the CIO as an information strategist, the leadership role of the CIO is a charismatic one: strategic and decisive, visionary, change oriented risk taker, and entrepreneurial.[5] During this "broad sweep" phase many factors operate to lead a CIO to feel like the "Rambo" of the machine room. It is exciting to wheel and deal and quite easy for the ego to get caught up in that process, particularly because computing often becomes the focal point within the institution.

The vendors loved us (at least some of them did). All one needed was some money, good negotiating skills, and a set of convictions about the inherent value of technology.

"Rambo"-type CIO's tend to be a peripatetic group, perhaps because they lose interest in the leadership role once the titillation of the infrastructure establishment period evaporates. The very characteristics that served so well in the acquisition phase must now be sublimated. Patience, cultivation, diplomacy, persistence are the essential qualities of the CIO who will lead the institution into the next phase of planning and execution.

Driven by the escalating costs of computing, institutions are entering a transitional planning stage in which they strive to connect expenditures for computational resources to tangible academic or administrative outcomes. Figure II shows the framework for making strategic linkages within and among the various planning environments: institutional, computational, academic and

[3] Syracuse University, Report of the Academic Computing Planning Committee, May 1986, p. 5.

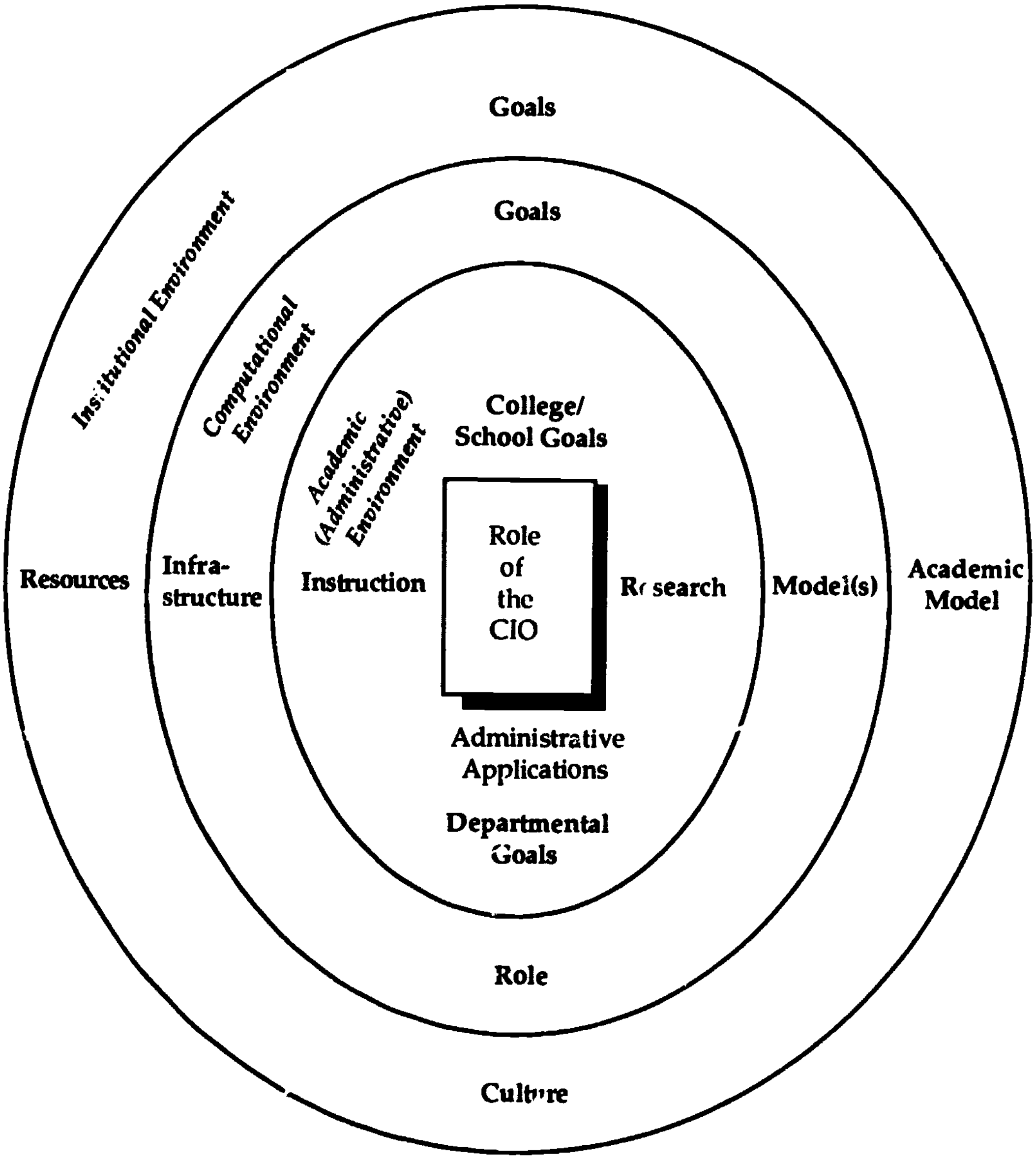
[4] The EDUTECH Report 4, "Chief Information Officers: New and Continuing Issues-Part 2," (July 1988).

[5] Adapted from "One Dean's View of Leadership Characteristics in a High Quality Professional School," Donald A. Marchand, Dean, School of Information Studies, Syracuse University.

administrative. The objectives in this planning phase are (1) to refine the computing environment, by filling-in, embellishing, and replacing components of the infrastructure, and (2) to establish boundary relationships integrating these goals, roles, and environments to produce the sought after linkages.

Figure II

Framework for Making Strategic Linkages



Integration of Goals, Roles and Environments

Planning takes on new characteristics; it is intense, continuous, proactive, and operates on several levels simultaneously. There is less control and predictability in the outcomes. More parties are regularly involved in goal setting and evaluation. Not only is the direct participation of the CIO instrumental to the successful outcome of the planning process, but other institutional officers, the

Vice Chancellor for Academic Affairs, Vice President for Research and Graduate Studies, and the Vice President for Undergraduate Studies, for example, also begin to play important roles in setting priorities. Like the amoeba, these computing plans gradually and subtly change shape; they often multiply into a series of smaller, unit plans.

This new phase requires the ability to discern, and to navigate through, the complex web of interrelationships that exist within the cultural context of an academic institution. There are no maps to follow along the path to making the academic linkages sought as a consequence of enormous expenditures for infrastructure. Each environment will have its own route. At best one may find directional hints from the conceptual models developed by those who have begun to explore this new leadership territory.

"Making it All Fit"

The second, transitional, stage of the computing strategy that follows from the strategic relationships shown in Figure I spawns action steps that strive to link the computing model to the academic (administrative) model within the culture of the institution: its values, vision, its mode of interaction; the way it does things.

The academic model at Syracuse University is characterized by its academic signature:

> "Syracuse University is...comprised of a relatively decentralized organization of schools, colleges, and academic support units...committed to a cooperative and interdisciplinary style and character. We are more nearly a rapidly developing than a *status quo* university...aspiring to numerous salient features of eminence. Our approach...stresses the balance and synergism between undergraduate and graduate/research programs. We seek to develop as a special signature 'Liberal and Professional Undergraduate Education Mutually Reinforcing.'...The cooperative [and interdisciplinary] mode intrinsic to our model...[suggests] widespread participation, allowing all academic units to buy into the program...with resources allocated on the criteria of quality, centrality, and demand.... We support each other and create new activities at our boundaries rather than act in isolation...[to] achieve this goal of balance and mutual reinforcement.[6]

The action steps for making strategic linkages derive from that signature.

Action Steps: Establish the linkage between the University's computing model and the academic goals of the University.

Link computing programs and facilities to the academic signature of the University.

Establish the linkage between high quality administrative systems and the academic goals of the University.

Promote the management of information as a resource by providing software, equipment, and services to encourage the penetration of end-user computing throughout the client areas.

[6] Gershon Vincow, "Academic Goals of Syracuse University Through 1995," Syracuse Record, 17 October 1988, pp. 6-7.

Allocate resources strategically.

Differentially allocate computing resources to reinforce the growth and renewal of academic programs in accordance with academic priorities, based on the criteria of quality, centrality, and demand, linking specific initiatives to specific outcomes.

Figure III shows the actual linkages between the elements of the University's academic signature and its computing facilities and programs. Since the University chooses to strive for a balanced approach to academic development, the computational resources provided must also be balanced in focus and furnished at a uniformly high quality level. Similarly, service and program offerings must reinforce the cooperative and interdisciplinary style and character of the University. For example, public clusters and specialized facilities, such as the graphics and design clusters and advanced computing support services, have a mandate to bring together people from different disciplines with similar interests. Distributed computing facilities, supported and unified by a strong core of centrally provided services, serve the heterogeneous collection of schools and colleges. Furthermore, numerous formal and informal committees and discussion groups supply opportunities for the larger academic community to provide guidance in setting the strategic and tactical goals for computing and its constituent units.

Figure III

Syracuse University Computing Strategy

LINKAGES	
Academic Signature	**Computing Programs and Facilities**
Balanced Approach Instruction and Research Liberal and Professional Undergraduate and Graduate	***Balanced Approach*** Faculty Assistance and Computing Education Services (FACES) Instructional Computing Services Research Computing Services Workstation Integration and Support Program (WISP) Student Facilities
Cooperative and Interdisciplinary Style and Character	Advanced Computing Support Services (ACSS) Joint Planning Program Graphics and Design Clusters Software Management Committee
Decentralized schools, colleges, and academic support units	Faculty Liaison Program Academic Computing Planning Committee Publications Program Distributed Facilities with Strong Central Support
Rapidly developing, not *status quo*	Progressive computing environment
Bootstrapping and Mutual Reinforcement	Resource allocation based on academic priorities
Aspire to eminence	Aspire to eminence

The University is in transition, owing to its decision to enter a phase of rapid development. For computing to exercise its defined role in that development the computational environment must be a progressive one. Similarly, the allocation of computational resources must be directly connected to academic priorities. Finally, since the academic and computing models are so strategically related, they must take parallel routes to eminence. The models for academic and administrative computing further support these connections.

Model for Academic Computing

- Progressive computing environment
- Rich, varied, and robust infrastructure
- Access to on- and off-campus resources
- Distributed facilities with a strong core of central support
- Aggressive deployment programs reaching beyond the nucleus of traditional users
- Aggressive support programs
- Seeking opportunities to play a leading role in selected areas
- Penetration into instruction and research through joint planning
- Monitoring of quality and productivity of use of computational resources
- Management of information as a resource
- Emphasis on communication (networks, publications, interpersonal)
- Continuous evaluation of programs and facilities
- Internal and external visibility

Coupled with a rejection of the *status quo* on the academic side is a long tradition of strong, sophisticated administrative support systems. The University is, thus, positioned so that a period of heavy emphasis on academic computing is feasible and both politically and fiscally acceptable.

Academic computing may be in the limelight but administrative computing is not mired in the *status quo*. The administrative model represents a shift of emphasis, away from data processing, toward the management of information as a resource. This change in direction has been accomplished by reallocating existing staff and budgets from traditional applications development groups to the support of two units that provide services to drive the institution in this new direction. This new thrust results in direct benefits, in the form of better and more readily available information, to the academic units.

Model for Administrative Computing

- All major business systems automated and online
- Use of fourth generation productivity tools and techniques to develop integrated systems more quickly
- Organized to balance cost containment against applications advancements

- Moving away from data processing toward information resource management.
- Organized to emphasize the importance of data administration and end-user computing to information resources management
- End-user modules built into new applications
- Use of electronic mail to achieve administrative goals through quick and efficient communications
- Administrative Computing Advisory Group provides guidance in setting policies and priorities

Both computing models are resource intensive to maintain and to promote. Consequently, to retain credibility with the institution's fiscal watchdogs, the CIO must make intelligent investments that are directly tied to the institution's academic (administrative) model.

Tactical Processes

The processes, associated with the allocation of computational resources, serve to form the sought after linkages between computing and academic goals and priorities. The tactical approach is to pursue the general goal of deploying the technology across all academic units with attention to both research and instructional requirements and a concern for achieving a measure of equity for the traditionally "have not" units. The sequence in which computing needs are addressed is determined in accordance with the overall priorities of Academic Affairs. The priorities of Academic Affairs are geared toward academic development and are articulated in terms of alternatives by discipline or unit: growth, renewal, or *status quo*. A joint planning and evaluation endeavor underway with selected academic units, in conjunction with the deployment of equipment, ensures that the technology is used productively and that its utilization penetrates the disciplines more rapidly.

In a period of rapid transition factions will form and rifts will arise between them unless, the entire institution understands the strategic relationships inherent in the attainment of its goals. As the institution becomes more selective in its equipment acquisitions, both purchases and gifts, the technical opportunities, much to the dismay of some vendors and academic administrators, do not always match academic goals. Concerns of risk and uncertainty shift from technical decisions to making a harmonious match between technological opportunity and an institutional requirement articulated within the academic priority structure. Sensitivity, awareness, diplomacy and care now become essential components of the CIO's leadership style. Far more consultation is required. Success is no longer found in the installation of a product; instead, it resides in the productivity of the clients and the quality of their work. As Erich Bloch, Director of the National Science Foundation said in his address at the recent EDUCOM Conference, "Technology makes things possible; people make things happen."[7] To become the orchestrator of the delicate interconnections inherent in this computing strategy, the new era CIO needs to add to the charismatic leadership

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[7] Erich Bloch, "The Strategic Importance of Education for Competitiveness," EDUCOM (Washington, D.C., 27 October 1988).

qualities that are taken for granted, the integrating attributes, shown in Figure IV, that are essential to a progressive computing environment.[8]

Figure IV

Characteristics of Leadership in a Progressive Computing Environment	
Charismatic Role •Strategic and Decisive •Visionary •Change Oriented Risk Taker •Entrepreneurial	*Integrating Role* •Oriented to Constituency Management •Empowering •Attentive •Collaborative •Communicates vision internally and externally •Realistic •Interdisciplinary View •Bridges academic and professional worlds

This computing model further requires that the staff, particularly those at the middle management levels, understand and practice the art of communication among themselves and with their clients; it requires the CIO to engage with the organization. The challenge to the CIO is to muster the sensitivity and patience to negotiate strategic academic alliances, to attend to the organization, and to adopt the type of management philosophy described so well by Peter Drucker in a recent *Harvard Business Review* article:

> "Every enterprise requires simple, clear, and unifying objectives. Its mission has to be clear enough and big enough to provide a common vision. The goals that embody it have to be clear, public, and often reaffirmed...[the culture of an organization] is the commitment throughout the enterprise to some common objectives and common values...and goals. ...[the enterprise] must be built on communication and on individual responsibility."[9]

Once the integrating characteristics of the leadership role assume ascendancy, the expectation is that the application of these principles of management will produce, as Drucker suggests, an organization with the capacity to achieve more with greater vision.[10]

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[8] Adapted from Marchand, Characteristics of Deans.

[9] Peter F. Drucker, "Management and the World's Work," Harvard Business Review, no.5 (September-October 1988):76.

[10] Ibid.

'PARTNERSHIPS' ARE THE FOCUS OF THIS INFORMATION SYSTEMS PLAN

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UK

ABSTRACT

Planning for Information Systems (IS) is a critical institutional activity, yet it tends to be maligned and misunderstood. IS planning is an essential 'enabling process' to position an institution to take advantage of opportunities and to exploit strengths. A technology-oriented vision, coupled with executive support is essential. IS plans should focus first on effectiveness rather than efficiency. Because computing and communications are so pervasive, IS planning at the University of Kentucky has sought to identify an institutional direction and commitment. Substantial resources will be necessary to achieve this plan; cooperation and partnerships (both internal and external) are of central importance.

An Overview of Information Systems Planning

In 1978, Steven Mueller (President of the Johns Hopkins University) spoke with clarity on the dramatic impact of the transition from the "go go" decade of the sixties to the apparent stagnation of the seventies upon higher education in the U.S. In Daedalus, he lamented "We are not where we were in American Higher Education." His message seems apropos to the technology professionals in higher education today for, if the decade of the 70's was the era of large central computing facilities, surely the decade of the 80's has been the decade of the departmental and the personal computer. We are not where we were. Decentralized, distributed, dispersed--by whatever term, we have shifted from the mainframe as the sole source of computing services, to the mainframe as one of many servers of computing resources in an increasingly homogeneous environment. The 'good-ol-days' when a central computing center had it all and could plan, manage and control it all are gone (and most of us would say, thank goodness!)

Because of this transformation Information Systems (IS) planning has become both more important, and more difficult. Not only has the technology proliferated, but so have the decision makers and the options. Diversity and uncertainty have replaced singularity and predictability as institutions try to plan for technology. Planners and decision makers are caught between the increasing economic affordability of discrete components of technology and the escalating total institutional investment in technology. It is increasingly apparent that technology investments must be viewed within the context of institutional strategic planning.

Information systems are horizontally oriented to offer services to a broad array of vertically aligned departments and divisions. Therefore, it is absolutely essential that a strong link be established between institutional strategic planning and information systems strategic planning. The former must precede the latter; information systems can offer a vehicle to achieve institutional strategic objectives but should not themselves become strategic objectives. In the final decade of the 20th century, the long term strategic value of information technology investments will have a profound impact upon our institutions. Strategic planning for information systems technology therefore becomes a critical responsibility for us all.

Strategic planning has become a much abused, and maligned concept in recent years. There seems to be countless seminars, workshops, conferences, monographs, and books, not to mention consultants, addressing this topic. IS strategic planning is an important institutional activity; its significance should be recognized throughout the organization. IS strategic planning positions an institution to respond to windows of opportunity, to capitalize on the unexpected, and to respond to pure chance. Information systems (IS) planning becomes an enabling process to benefit the entire organization. IS strategic planning should offer a vision of a new order, of

new processes and ways of doing things. An IS plan helps to define the vision; if an institution does not begin with a defined vision of where it is going (a strategic plan), it is difficult to judge whether the institution has achieved its goals. Without a vision institutions cannot and should not expect great results; an institution may realize discrete and isolated random benefits but broad, strategic benefits will seldom be realized. IS planning demands a technology-driven vision premised upon an understanding of institutional goals. A technology-driven vision is essential to recognize the potential technology offers and to make the necessary investments to reap the benefits. IS planning should hold out the promise of significant improvements over today's reality. Successful IS planning should culminate in the formation of an institutional strategic asset--the technology infrastructure to support broad institutional goals.

Leadership at executive levels is absolutely essential and is a prerequisite to successful IS planning. This executive involvement and interest must be ongoing. To sustain their interest, decision makers must understand technology; administrators who are unaware of the role and potential of technology cannot take advantage of it in their daily professional lives and consequently will be unlikely to champion its cause in resource allocation decisions.

Planning for IS is difficult; not only are the expenses high but so are the ambiguities and uncertainties. Many managers are effective at managing and understanding smaller, single-focused investments/projects which have correspondingly smaller benefits and returns on investments. But few are as successful at understanding and managing something as large and diffused as investments in information technology. Understanding, planning, and managing information technology means shifting from regarding IS as an expense, or a cost, and instead as an asset. It means shifting perspectives and expectations from a short term to a long term horizon. And finally, it means shifting from local, operational-level thinking, to organizational, strategic-level thinking. Strategic IS plans must focus on support for the larger issues confronting an institution, and thus should reflect the thinking of decision makers who understand broader institutional issues.

The IS planning process should be tempered with reason and understanding; it should not become an intimidating process. One of the keys to successful IS planning is to accept the inevitability of change and to establish reasonable and achievable goals. The historian, Henry Steele Commager, has observed that "change does not always assure progress, but progress implacably requires change." Technological change is inescapable; IS planning goals must balance technological opportunities with institutional realities. If planning goals are unreasonable so likely will be the results; if unrealistic, then the effort is likely doomed to failure. Effectiveness and efficiency are other concepts which are often touted, but which should be qualified in the context of IS planning. An IS plan should focus on

effectiveness, rather than on efficiency. Efficiency is a cost-oriented concept, while effectiveness is a results-oriented concept. Peter Drucker once observed that "there is nothing quite so useless as doing with great efficiency that which should not be done at all." Put another way, efficiency is doing things right while effectiveness is doing the right things. An IS plan must first be effective in its support for institutional goals; its efficiency can subsequently be judged in the context of operational realities.

Information Systems Planning At The University of Kentucky

Computing at the University of Kentucky (UK) has grown from modest beginnings in 1958. Today, the University of Kentucky operates sophisticated and technically state-of-the-art computing and communications facilities. Computing and communications have become interwoven within the daily activities of teaching, research, and service occurring in hundreds of departments and physical locations of the University. The University of Kentucky is the statewide land grant and research institution for the Commonwealth of Kentucky; technology enables UK to reach not only its local community of interest but to embrace a national constituency with international extensions.

Technological decisions are dependent upon market choices available at a given time; there likely will always be a "better" product or service forthcoming. To wait for the next "latest and greatest" can render the consumer helpless. The University cannot afford to wait for the "best" product or service which may (or may not) be available despite marketing hype. Technological decisions are temporal and must be based on both an assessment of known and anticipated needs as well as on available products and services. UK's strategy is less an architectural blueprint and more an evolutionary prospectus for interweaving technological innovation with institutional evolution. Technology becomes the means, not the end, and emerges as the indispensable partner which empowers the University to take advantage of windows of opportunity in its quest for excellence.

Computing and communications strategies provide essential support to educational policies and curricular needs (not vice versa). UK is committed to integrating and utilizing technology whenever possible to facilitate the learning process, to sustain and enhance leading edge research activities, and to manage scarce resources in the most effective manner. The University seeks to encourage and nurture a functional as well as a conceptual level of "technological fluency" to enable its community to understand the power of information technologies while developing individual facility to utilize these various technologies in support of personal and professional requirements. UK's plan recognizes that information technology can materially improve the quantity and quality of research opportunities, can enrich and strengthen instructional and learning opportunities, and can measurably improve both the capabilities and cost effectiveness of administration and management

activities. Technology can significantly contribute to the processes of learning and can catapult areas of specialization into recognized spheres of influence and expertise.

Because computing and communications had become so pervasive throughout the institution, a statement of institutional directions and objectives was required. The resulting strategy outlined a prospectus for the continuing evolution of information systems (both computing and communications) at the University, with emphasis upon broad goals rather than narrowly proscribed objectives. The University has, and will continue to support, a pluralistic approach to address the broad range of computing and communications needs. While individuals and departments retain the flexibility to determine their own individual requirements, it was incumbent upon the University to define broad, generic directions and to provide the appropriate support services to interface diverse local facilities to institution-wide information services and facilities. UK's plan attempted to outline these broad generic directions within a framework which could assist departments and individuals in making local decisions. With a clearer understanding of institutional directions and commitments, individuals and department could more effectively evaluate alternatives to best address their local needs.

Technology has made rapid and dramatic advances in the last decade; the pace continues to accelerate. Fueled by popular press reports of the promises of technology's potential and by rising levels of computing literacy, information users throughout the University evidenced an increasingly sophisticated and insatiable demand for computing and communication services and resources. The directions outlined in the plan were premised upon support for institutional, operational, and strategic objectives and not upon the glamour that technology promises. As an institution "WHY" questions had to be addressed first, otherwise the allure of the "HOW" and the politics of the "WHO" questions would delay and confuse the process.

Central to developing UK's strategic plan was the definition of a vision - what potentially might be rather than the repetition of what has been; not technology for technology's sake but technology to sustain the University and to expand its broader missions of teaching, research, and service. Sophisticated information systems will position the University to anticipate and reach out to new opportunities in its environment.

UK's plan was not a forecast of what will be. Strategic plans for information systems are not precise, predictive forecasts. Instead, the plan offered a strategy for anticipating changing needs and for taking advantage of rapidly changing technological opportunities. IS strategic plans should be both analytical and judgmental, based upon sound analytical techniques and collective thought

processes to commit resources in support of institutional priorities. The plan was the synthesis of thought, analysis, imagination, and judgment tempered with healthy skepticism. This strategic plan did not seek to make decisions in the future but, instead, to anticipate the future consequences of decisions made today. As such, the plan was not a detailed blueprint for construction, but rather a broadly-defined outline upon which future specifics could be detailed and incorporated into the biennial planning and budgeting process in support of evolving institutional goals.

Assumptions Underlying The Systems Plan

Information systems, of necessity, are heavily influenced by the availability of technology. Information systems, much as physical facilities, evolve in response to and in support of larger institutional goals. An effective information systems strategy, therefore, must balance technology opportunities with how the institution views itself and how it chooses to conduct its affairs.

Some basic assumptions about information and technology were required to provide the foundation for UK's plan. These assumptions included:

- Pluralism of local/native computing environments will continue and likely accelerate. Diverse communities of interest demanding specialized computing environments will continue to emerge.

- The University has a major investment in decentralized, multi-vendor computing resources. This investment will continue to be encouraged and supported; however, compatibility and consistency with institutional objectives will be encouraged.

- Communications (multi-media, including voice, data, and video) technology is rapidly expanding in both complexity and in required resources. Functionally rich communications facilities are essential to support the complex information manipulation requirements of the University.

- Advances in technology will continue to drive prices down while escalating performance and power capabilities. This phenomenon is perhaps most evident at the desktop level. This trend shows no sign of abating.

- Resource demands will continue to outpace resource availability, which will necessitate careful planning and prioritizing of information services and facilities.

- Adoption, albeit gradually, of national and international standards and models within the industry will continue. The University will increasingly turn to

products and applications which utilize standards (OSI, ANSI, CCITT, etc.) and models as the only hope for real connectivity and compatibility.

- Large-scale, general purpose computing resources, centrally located and broadly accessible, will continue to be the cornerstone of the University's computing strategy. Similarly, the University will provide central, numeric-intensive computing services capable of supporting advanced scientific research across an array of disciplines.

- Integration of the most commonly used, multi-vendor based office automation and personal services support packages will be accomplished. Integrated office support services based on commonly defined, generic industry standards should be available including the ability to transfer and edit text, to send mail and messages, and to share data files, spread sheets, and graphic output. This comprehensive office support environment will be further strengthened by the availability of local electronic maintenance/repair facilities offering favorable rates, by common training facilities, by favorable site licenses for software, and by emergence of a commonly trained pool of support staff.

Partnerships Are Essential To Achieve The Strategy

Computing and communications technologies are too pervasive and too expensive to realistically propose they be funded or supported from one (central) source. Institution-level resources are not adequate to support all levels of need and are probably not appropriate for all levels anyway. Just as in the past, financial support for local computing and communications will remain diffused throughout the organization. Experience suggests that those closest to using the facilities can make the best budgetary prioritization and allocation decisions (at least in the opinion of the users). Complementing this observation, however, was the recognition of the institutional nature of computing and communications, and, therefore, of the need for an institution-level plan and an institution-level financial commitment. Today's teaching and learning activities are heavily influenced by the infusion of technology; clearly an institutional financial commitment was needed. This institution-level commitment necessitates a partnership of central and distributed resources along with central and departmental leadership to insure success.

Technology is not inexpensive; to sustain the University's commitment to encourage technology in all facets of learning and research requires significant and ongoing infusions of recurring and non-recurring dollars. Funding and allocation strategies related to technology must be consistent with and supportive of this institutional commitment.

To realize the potential which technology promises, an architectural outline or

infrastructure to support the continuous evolution of technology across the University had to be established. This infrastructure consisted of a definition of services and associated responsibilities, an organizational outline, and associated resource allocation strategies. A decentralized approach to establishing this infrastructure was neither practical nor reasonable; nor was a decentralized approach to funding it. And, perhaps, most importantly, a decentralized funding approach was unlikely to result in the University achieving broader institutional goals. An institution-level commitment of resources was the necessary precursor to exploiting the potential of information technology.

Prior to the current fiscal year, recurring institutional commitment in support of University-wide computing and communications had remained relatively constant (on a real dollar basis), and as a percentage of institution budget, it had actually declined. Concurrently, expenditures at the local and department/division level had risen dramatically. This contradictory support pattern resulted in a fragmented, decentralized, and disproportionate distribution of technology across the institution. To redress these imbalances and inequities, and to insure that institutional objectives were adequately supported, an institution-level commitment of resources was required.

Additional expenditures of several millions of dollars in each of the next several years was necessary to achieve even limited objectives. Clearly, new directions and initiatives were necessary to keep pace with technological opportunities while recognizing economic realities. The University budget was strained; major infusions of additional state funds are unlikely in the next several years. Capacity within present budgetary formulas and allocation schemes to support even modest evolutionary growth, let alone explosive and revolutionary expansion of technology, were extremely limited.

Where, then, should the responsibility lie for funding this institutional commitment to technology?

Financing is arguably the most difficult aspect of defining and implementing an institutional strategy for technology. The financing strategy must be recognizable, consistent, and equitable, with the objective to share the obligations essential to meet the commitments. A partnership must be forged across all organization levels and divisions (individual, departmental, sector, and central) to focus upon this strategic initiative. It is not appropriate to expect an institution-level office (i.e: the Information Systems Division) to become the locus for all funding activity. In practice, this central office will certainly influence the types and nature of local expenditures as an outgrowth of coordinating institutional strategies and directions, but should not be looked to as the source of funds. This office is the steward of the strategic architecture, rather than the central bank to provide capital resources.

The financing alternatives to achieve the plan are relatively straightforward: solicit new, additional funds, or reallocate current funds. If the financing strategy assumes that relatively flat budget growth over the next several years (in constant dollars) will occur, then questions of what current services to cut back or phase out, or what current users to reduce, or eliminate support to, will have to be addressed. If the financing strategy, however, assumes that significant new funds can be attracted (from various initiatives), then the financial impacts of this growth upon other areas of the University can be moderated.

As noted earlier, subtle but dramatic shifts in funding responsibilities for computing and communications have already occurred in recent years. At the personal computing level, increasing numbers of students and faculty have been purchasing their own equipment. Departments and divisions have also increasingly provided personal computers and/or workstations for their faculty and staff. Extramural funds (grants and donations) have materially contributed to the quantity and quality of computing equipment (particularly in laboratory settings). Departments and divisions have assumed the interconnect charges to link their computing facilities via the communications network to institutional resources and national networks. All of these expenditures have occurred with little commensurate shift in budget allocation to the local departments. While University-wide (institutional level) services continue to be funded centrally, departments and divisions have absorbed their portion of costs through reallocation of current funds, through fund balances, or through grants and donations. For many departments and divisions, providing computing and communications support has become a dominant budget item, superseded only by personnel-related costs.

A critical reexamination of funding and allocation strategies in support of institutional computing and communications objectives seems in order. It is neither realistic nor reasonable to assume that everyone will continue to do all they have done before, and support these activities to an adequate level, plus do more as the University moves forward with new initiatives in technology. The only rational conclusion is that significant new funding sources need to be developed at both local and institution levels. Partnerships emerge as the key to future success.

Various partnership opportunities exist. Externally focused partnerships in the following areas offer promise:

- joint undertakings with corporate partners in the computing and communications industry to develop products and/or services of local utility with broader market appeal;

- coordinated negotiations with regional and national foundations which share

particular areas of interest in developing innovative applications of technology in support of foundation commitments;

- state government through general fund allocations and state-supported bond issues;

- grant and corporate gift programs which capitalize on recognized areas of faculty research expertise.

- participation in regional and national consortia; and

- cooperative efforts with other higher education institutions.

Likewise, internally focused partnerships in a variety of areas are essential, including:

- joint activities with distributed computing facilities on campus to consolidate basic services such as printing, backup, and disaster recovery facilities;

- sharing the cost of acquiring software, especially for institution-wide site licenses;

- sharing personnel resources, ranging from joint faculty appointments in computing services areas, to sharing scarce technical support in critical areas such as operating systems and communications;

- sharing responsibility for funding both the availability of services as well as access to those services. i.e: central responsibility for providing the broad-based services with local responsibility for providing access; and

- sharing responsibility for and participation in the information systems planning process, such that both customers as well as providers of information system services share in defining the vision of the future.

Regardless of the internal or external focus of the partnerships, it is essential that all parties enter into the relationship as equals with recognized strengths. Each partner expects to gain from the relationship. In this view of a partnership, each participant enters into the relationship with a hand extended sideways (as in a handshake) representing respect, and an expectation to learn and to benefit. The alternative is for one participant to enter into the relationship with hand extended palm up, (as in begging) representing inequality and an expectation of something for nothing. This relationship is not really a partnership at all, but more of a benefactor - supplicant

relationship. For the University of Kentucky, a partnership perspective based upon equality and respect is integral to the achievement of its Information Systems strategy.

After considering the economics and the expectations surrounding information systems at UK, it was apparent that new structures, techniques, and approaches were essential. If the University is to realize the potential of its commitment to information technology, the various partners in the process must be recognized. Partnerships will mean the difference between success and failure in this effort. Successful partnerships capitalize upon the strengths of each of the participants. The relationship builds upon strengths such that the whole is truly greater than the sum of each part. When each partner brings strength, each contributes to and shares in the success of the partnership. The successful partnership maintains a dynamic, rather than steady state view of the relationship of the participants and of the goals to be addressed. And in the process, each partner emerges as a winner.

Strategic Planning for Technology at the Wharton School: Facilitating Change

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Abstract:

To be effective, technology planning must be linked to the larger goals of the organization. This paper presents the technology planning process at the Wharton School: a seven-step program to evaluate technology issues in light of the goals embodied in the School's Plan for Preeminence. Sample cases are presented illustrating how this process has been applied to two major technology problems: providing consistent hardware growth plans adaptable to changing demands, and developing an organizational model for research computing support.

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INTRODUCTION

As professionals in the field of information technology we have experienced dramatic changes in our industry over the past five years. Obviously, these changes have been directly influenced by the rapid and seemingly endless pace of technological development. This technological "revolution," however, can best be characterized as a double-edged sword for most technology professionals. While it is clearly exciting and rewarding, it also presents many difficulties. Just a short time ago many of us would have characterized ourselves as change agents in our respective educational institutions, preaching the gospel of technological innovation to our constituencies. Today, if we are not careful, we may become the victims of the change we have so ardently advocated.

With the previous concern in mind, it is our position that the technology professional today, and for the foreseeable future, must become an effective manager of change. We believe that successful change management requires an ongoing, structured, and focused technology planning program grounded in a clearly defined and articulated set of institutional goals.

Our experience suggests that effective computing planning cannot succeed in the absence of a clear and well-publicized institutional strategy. In our opinion, planning for technology in the absence of an institutional strategy almost guarantees that one will be victimized by change

This paper will examine the ways in which institutional strategy and computing strategy can be linked in order to ensure that the technological infrastructure adequately responds to the needs and goals of the organization. Although we believe strongly that a formal institutional strategy is the key element in effective computing planning, it is by no means a guarantee of success. While the linkage to the institutional plan is crucial, the technology planning process must also follow a well-defined path with a clear set of objectives.

BACKGROUND

The Wharton School of the University of Pennsylvania is one of the premier business schools in the world. Wharton enrolls over 5,100 students in degree-granting programs: approximately 1600 MBA and 400 Ph.D. candidates, 3000 undergraduate and evening-school students, and 175 participants in the executive MBA program. The standing faculty numbers approximately 180, supported by an administrative staff of 360. The School also serves some 5000 middle- and senior-level managers each year in its various Executive Education programs.

As with most institutions of higher education, computing has become an integral part of the mission and operation of the school. From research supported by large systems to LOTUS 1-2-3 class exercises on personal computers, the applications are as diverse as the faculty and students that generate them.

Academic computing at the University of Pennsylvania has historically been decentralized, with primary support provided at the school level. As a result, the Wharton School developed its own internal academic computing center—Wharton Computing and Instructional Technology (WCIT)—during the early seventies. In response to its growing research and instructional needs, in the mid-seventies the School purchased a DEC 10 to meet the demand for both student and faculty computing. The nature of the environment provided by WCIT remained essentially unchanged from this period until late 1983. As the need to expand several areas of research and instructional computing became evident, particularly in the area of integration of personal computers, the responsibilities of the computer center began to change rapidly.

THE PLAN FOR PREEMINENCE

When Russell E. Palmer became Dean of the Wharton School in 1983, he recognized the emerging role of computer technology and the strategic importance of this technology for business education and research. Improved computing hardware and support were key elements in his vision for the Wharton School, and received major emphasis. Of even greater importance to the School, however, is the Dean's commitment to strategic planning to achieve a collective vision for the long-term future of Wharton.

During his first year at Wharton, the Dean instituted a planning process with a five-year horizon that encompasses all entities of the school. Entitled the "Plan for

Preeminence," its aim is to "assure that the Wharton School is the finest school of management in the world." The plan detailed an approach to this mission that encompassed developing excellence in education, research, and life-long learning. Toward these ends, the Plan for Preeminence established ten school-wide strategic goals that became challenges to be met by all academic and administrative departments. The ten goals are as follows:

1. *Attract and Retain the Best Faculty.*
2. *Attract and Place the Best Students.*
3. *Do the Best Research.*
4. *Provide the Best Education.*
5. *Build on Excellence; Develop and Upgrade Selected Areas; Consolidate, Eliminate, or Maintain Selected Areas; Work Toward Our Collective Vision.*
6. *Have Effective Internal University Relations Conducive to the Achievement of the University's and Wharton's Goals.*
7. *Have the Best Image Portraying Our Accomplishments.*
8. *Have Excellent Facilities.*
9. *Have Necessary Resources.*
10. *Foster an Attitude of Working Together to Achieve Our Collective Goals and Long Term Mission.*

After five years, these goals have become institutionalized measures of the success that the School is experiencing in its overall efforts. As part of this "living" planning process each academic and administrative department develops its unique contribution to the plan during an annual update. Each month, departments submit measures of critical activities which contribute to, or detract from, goal achievement. These monthly updates are then consolidated into a management briefing book that is reviewed quarterly by Wharton senior management. At the beginning of each new plan year the process requires that a summary of the previous year's accomplishments be prepared with a specific review of the key actions cited for accomplishment that year. Although the academic environment frequently does not embrace careful planning, Wharton's system has received strong support throughout the School.

Planning for technology at Wharton is greatly facilitated by the Plan for Preeminence. Rather than guessing at the appropriateness of a technology or service, WCIT has developed a planning process that can be applied uniformly to each topic under consideration.

The first step during each annual planning cycle is to review the school-wide goals in light of outstanding computing needs. We then review these issues looking for common threads, and, ultimately, develop a list of areas to prioritize and address.

To illustrate the outcome of this process an example has been extracted in its entirety from the WCIT 1988/89 Annual Plan Update (Figure 1). This example outlines WCIT's response for fiscal 1988/89 to the fourth goal of the Plan for Preeminence, "Provide the Best Education."

As can be seen by this example, WCIT has identified a set of specific activities that respond to the goal in question. The second, and equally important, step in the process is the actual planning to determine the specific programs and projects to achieve the stated objectives. In the next section we will outline this process and the philosophy that underlies it.

OUR PHILOSOPHY

Our basic strategy is to create a system and an organization that are adept at managing change. The goal of our strategy is to allow for modification of all parts of the system with low incremental cost to the organization. In many ways the strategy precludes any definition of a final hardware/software/network/service solution. It does, however, provide the organization with the ability to rapidly exploit changes in technology or demand. We believe this approach is consistent with the state and evolution of the industry today. We evaluate all offerings on their ability to permit addition or migration of function at minimal incremental cost and service disruption.

Are we succeeding? We think so. If we are to continue to succeed, however, it will not be because we have the best technological strategy, but rather because our solutions respond directly to the goals and changing needs of the institution.

OUR PLANNING PROCESS—THE MODEL

The planning process we have adopted requires that every specific technology issue first be evaluated in light of its link to school goals. At a later step in the process, the issue will be reviewed again, relative to the institution's goals, once alternatives have been evaluated and a solution identified. These steps ensure that only the highest priority areas are considered as the annual plan evolves.

GOAL 4: Provide the Best Education

Subgoals:

1. Provide appropriate tools and services for courses.
2. Teach the use of information technology and understanding of functions.
3. Promote alignment of the information technology used in the curriculum with the requirements and environments of the business world.
4. Provide support for, and coordination of, faculty courseware development.

Factors Inhibiting Achievement of Goals:

1. Cost of supporting broad range of hardware and software.
2. Insufficient availability of presentation-quality output devices.
3. Lack of suitable local area network services for student computing.
4. Degree of knowledge and skill required of users to maintain and access large databases.

Alternatives/Courses of Action to Achieve Goals:

1. Provide support staff with better training and sensitivity to student needs.
2. Coordinate closely with faculty on assignments to be certain that the students are properly prepared and the assignments are properly tested.
3. Develop additional shortcourses targeted to the requirements of MBA and PHD students.
4. Enhance online documentation and services description.
5. Enhance laboratory network services.
6. Provide lab laser printing services.
7. Install alternative prototype integrated teaching stations in classrooms.
8. Launch electronic publication support program.

***FIGURE 1:** Extract from WCIT's 1988-89 Annual Plan: "Goal 4: Provide the Best Education"*

There are seven steps in this process:

- Define the issue
- Link to school-wide goals
- Identify and evaluate alternatives
- Prioritize and re-link to school goals
- Implement a pilot project
- Make a recommendation
- Market the solution

Define the Issue

Issue definition is based upon methodical study of the school-wide environment and the technological alternatives. The two primary components of this step are data collection and analysis.

Collect Data

The first step in each case has been to develop as thorough an understanding of the internal environment as possible. We generally attempt to conduct a census of all stakeholders and a complete inventory of resources. In some cases we use questionnaires. In other cases, such as development of a hardware plan, we conduct focused group interviews with all interested faculty, department by department.

Analyze Data

Analysis of the data often presents a set of ordered functional priorities which are sometimes at odds with the functional attributes of the technological alternatives. Our job is to wrestle with these incompatibilities. The goal is to develop a list of concerns that need to be investigated under field conditions. These concerns detail the functional requirements necessary to achieve success.

Link to School-wide Goals

More often than not, strategic issues are disguised as operational problems. The biggest mistake we can make is to solve today's problem with a solution that subverts long range strategy. We are better off implementing solutions which are less than optimal for the problem at hand yet move us another step in the direction we want to go. The exercise of linking an issue to the school-wide goals forces a focus on the long term, and generally clarifies the significance of the issue to the organization.

Identify and Evaluate Alternatives

Our key criteria in evaluating alternatives include:

- fit with existing infrastructure,
- compatibility with standards (especially interfaces), and
- strategic relationships with the vendors.

Prioritize and Re-link to School Goals

It is easy to become so enmeshed in the planning process that the planning team loses sight of the strategic goals of the school. As the issue and its alternative solutions come into focus, it is important to reconsider its place in the big picture. This often suggests a reordering of the emerging issues and their priorities. The result of this activity is a statement of strategy rather than a plan for action. The principal components of the strategy are a suggested solution and the criteria against which to measure its goodness of fit.

Implement a Pilot Project

The purpose of a pilot project is not simply to see if the proposed solution works. Its purpose is to gain an understanding of the total impact of the proposed solution on the organization. How well will it fit and interact with the installed base? What is the cost, time, and effort required to install, maintain, and migrate the solution? What are the true impacts on the job for which it was targeted? How successful is it at achieving the strategic objectives?

Make the Recommendation

Once the management team agrees that the strategy is feasible, the recommendation process begins. The proposed solution must address policy, cost, and support issues.

Policy

No issue is so completely technical that it does not significantly affect the way the organization carries out its work. The pilot project is designed to uncover policy issues which must be addressed prior to implementation. For example, any hardware or software strategy must address the individual user's costs of migration, while a staffing strategy must address potential conflicts with university personnel policies.

Costs

Central to the culture of the Wharton School is the location of a great deal of responsibility and authority at the departmental level. Department heads are responsible for executing the strategic plan and have a great deal of discretion as to how to allocate available resources to that end. The result of our process is often little more than a recommendation to the department heads as to how to

spend their money—but it is based on our experience and extensive research.

Support

As the departments begin implementing our recommended solution, our role shifts to providing support. Our recommendation document must include a description of the support role we envision.

Market the Solution

We have come to believe in the power of a comprehensive marketing effort. The recommendation does not sell itself. Our marketing efforts include special mailings, testimonials by pilot participants, and many presentations to groups of stakeholders.

SAMPLE CASES

This model is currently in place and has been used to address many technology issues at the Wharton School. To illustrate how this planning tool has been implemented we have selected two diverse issues which were addressed using the model. The first case outlines the process employed to select our multi-vendor large systems hardware platform, while the second addresses our concern for a creative solution to our academic research staff support needs.

These cases demonstrate that, once an organization has internalized the process of planning, the methodology is equally adept at addressing areas as diverse as hardware selection and organizational development. Said another way, when planning becomes an organizational state of mind within an institution, aligning the technology resource with institutional goals becomes second nature.

CASE 1: LARGE SYSTEM CAPACITY

Defining the Issue

Our task was to find a new capacity expansion strategy that would adapt to changing demands in a coherent, consistent way. Over the previous two years, despite two carefully planned increases in our large DEC systems capacity, user demand could not be met. As Figure 2 shows, each CPU increment had been almost immediately saturated by unexpected levels of latent demand from research faculty.

Data Collection

As a starting point, we collected and reviewed two years of system performance and capacity utilization statistics. We knew from our recent experience, however, that such historical data alone would not inform us about *future* needs. We therefore also undertook a systematic, intensive, direct survey of the faculty, with the goal of obtaining a comprehensive understanding of current and long-term needs of our end users. Department by department, we conducted group interviews with all interested faculty and key administrative staff. These proved to be excellent forums for discussing current and long-term computing needs and preferences.

Analysis

The interviews confirmed that the only certainty in our computing environment is its need to continually change. Traditional capacity planning had already proved futile in our environment, for three reasons First, the inherent volatility of research demand is enormous. Individual faculty research projects can consume weeks of CPU time and are extremely cyclical, leading to severe peak loading. Furthermore, individual faculty members, even in a standing faculty of nearly 200, can materially affect the load. What if Dr. X, an expert in optimization theory, gets a new grant? What if Dr. Y, a leading analyst of patterns in stock market transactions, leaves the school? What if Professor Z from a competing research institution accepts the School's offer of a chair in Econometrics? An important factor in the explosive demand for Wharton's large system resources has been the shift among the faculty toward greater use of computing: nearly one-half of the School's current faculty has been recruited in the past five years, and the newer members have a greater propensity to use high technology in their teaching and research.

Second, in the administrative area, we had begun a series of office automation pilot efforts intended to take the entire organization toward the information age. We could not adequately project our administrative requirements based on these pilot projects, other than to state that the needs would be commensurate with penetration of the technology.

Third, traditional capacity planning methods could not account for the dynamic effects of changes being made in our environment. Future disk capacity, for example, would depend in part on the network services Wharton and the University were planning to provide. True network computing would include the ability to share files transparently and to utilize network procedures for data backup. Would this increase or decrease our large system disk demand? How would it affect departmental or workstation disk requirements? All we could be sure of is that requirements will change.

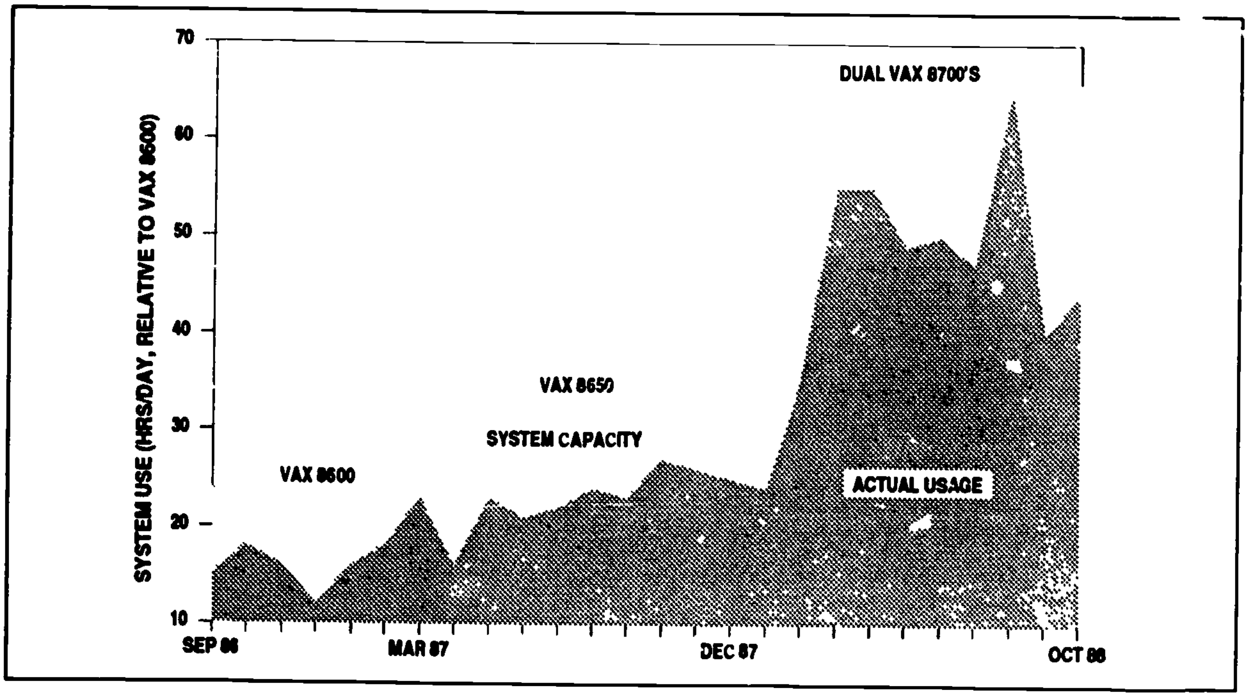


FIGURE 2: PRIME TIME CPU USAGE
Each CPU increase was almost immediately saturated by unexpected levels of latent demand.

Linking to School-wide Goals

The goal of becoming the world's preeminent school of business dictated the need for a world-class computer and information systems infrastructure. The large systems capacity strategy responded directly to Goals 1 through 5, 8, and 9 in the Plan for Preeminence.

Identifying and Evaluating Alternatives

Based on our analyses of the School's and the University's computing environments, our current large system needs and constraints, the faculty's expressed preferences, and probable costs, we decided that Digital Equipment Corporation and/or IBM were the vendors most able to respond to our needs for flexible capacity solutions. Our requirements were presented to them in a formal *Request for Information for a Computing Solution* (RFI).

From our technical review of their responses to the RFI, along with knowledge of IBM and DEC's respective product lines, we concluded that a single vendor solution would not meet our needs. It became clear that our central requirements were a standardized platform which would facilitate a range of alternative vendors' equipment, and an approach offering flexible, incremental enhancement. We recognized that networking, at the department, school, and university levels, was the key to this future flexibility to add and share resources.

Prioritizing and Re-linking to School Goals

A key objective of our strategic planning process was a more dynamic alignment of resources to demand. The growth in demand was in large part an indirect effect of several School-wide trends tied to the Plan for Preeminence—an aggressive faculty and student recruitment program (Goals 1 and 2), and specific emphasis on upgrading instruction and research quality (Goals 3 and 4). To respond to this steadily increasing demand, we needed to address more than an immediate question of what hardware to buy. We had to select a platform tied to a vision of where Wharton, and hence our organization, would be moving over the next several years.

Implementing the Pilot Project

Our recent experience in planned capacity increases provided, for us, a counter-implementation. In retrospect, it served as the first pilot we conducted in this particular planning process. Its lesson was that we needed a flexible technological platform on which we could carry out many "pilot" efforts, each addressed to specific capacity issues.

Having experienced first hand the dangers of estimating the generic performance specifications of a system,

we felt that we had to do everything possible to reduce the potential margin for error in determining the suitability of a particular configuration. Toward this end, a "typical" load was devised by assembling a representative sample of faculty programs. This suite of programs was run on each system under consideration by our senior systems programmer.

Although this process entailed significant time commitments, travel expenses, and vendor arm-twisting, the value of the effort was demonstrated in two significant ways. First, the ability to conduct side-by-side comparisons of the benchmarks raised the confidence level of the planning team in the multi-system solution. Second, and more importantly, the process raised the confidence of the School's management in the acquisition recommendation.

Making the Recommendation

A DEC VAX platform was selected to address our *horizontal* capacity needs at the central, departmental, and workstation levels. We recommended a VAXcluster comprised of two 8700s as the central component, nearly doubling our capacity over the single 8650. To complete this horizontal platform, we continued our conversion of the School's data communications system to Ethernet-based TCP/IP and Decnet, and completed interfaces to PennNet, the University's AT&T-supplied Integrated Services Network (ISN).

To augment that central horizontal resource, *vertical* capacity could be added in a number of ways. One type of vertical enhancement we recommended immediately was the addition of a Floating Point Systems M64/60 mini-supercomputer to the 8700 cluster, to provide high performance CPU capacity for compute-intensive VAX users. A second vertical enhancement recommendation was an IBM 9370 Model 90 computer, to provide a local IBM resource to support I/O intensive work and connectivity to the School of Arts and Sciences' IBM 3090 mainframe. This introduction of IBM hardware responded directly to specific faculty research needs for native IBM software, large CPU requirements, and facility in handling large datasets and research databases.

Beyond the IBM 9370 and the FPS M64, we envisioned future vertical-type additions, to support administrative and research needs as they develop over time. These would include, for example, the addition of DEC MicroVAX systems to the cluster, dedicated to particular applications or departmental groups.

Marketing

The marketing effort actually began prior to our final recommendation. We used departmental and School-wide meetings to inform our constituencies of the issues and potential solutions, and to gain the support of the faculty and senior management.

Once our recommendations for a combined Digital/IBM/FPS solution were determined, we used meetings and published documents to communicate them to senior management and the faculty. Announcements were placed in the School's newspaper, and in our own publications, including the semester announcement letter to faculty and our *Guide to Services*. In addition, we produced a special brochure mailed to all faculty and staff.

Now that the systems are in place, we have turned our marketing efforts to promoting the new capacity and helping selected users migrate to the FPS and 9370 systems. For these new systems, we have launched an outreach program to identify projects and specific faculty that would benefit from the FPS's power or the IBM's data-management capabilities. Training and individual support assistance is being directed toward these users.

Summary

The decision to provide a network-based Digital/IBM/FPS computing environment accomplished two important goals:

- it provided flexible large system research capabilities for faculty and students, and
- the strategy positioned Wharton in the computing forefront among the School's peer institutions, with excellent hardware and software from the industry's leading vendors.

Our chosen strategy has already proven to be a fortunate one. In the past two months, for example, we have added two Microvax 3600s and are now migrating administrative users from the academic VAX 8700 cluster to MicroVAX systems. In so doing, we have been able to provide capacity increments for expanding administrative needs, at the same time increasing the resources available to academic users.

CASE 2: RESEARCH COMPUTING SUPPORT

Defining the Issue

The primary objective of this plan was to recommend a course of action for enhanced research computing support for the School.

Data Collection

For this effort we reviewed data from other WCIT planning studies and conducted supplemental interviews with selected faculty and Department Chairs. We found that faculty desired additional software and dataset support, higher-level consulting and advisory services, and relief from clerical and low-level technical details related to computing. Department chairs and computing committees needed help in their technology planning, in managing their growing inventories of equipment and software, and most importantly, in recruiting and retaining technical support staff.

Analysis

Historically, Wharton's approach to research computing services was two-pronged—WCIT providing support for a common set of general tools, and departments having responsibility for their specialized local needs. These components rested on the two beliefs that, first, departments can best assess and prioritize their unique needs if given direct responsibility for them, and second, more widely shared requirements are more efficiently addressed through a common support organization. But the separation that evolved between intra-departmental support efforts and central services proved less than optimal.

Linking to School-wide Goals

The goal of the planning effort was to increase faculty research productivity through an improved range of services (Plan for Preeminence Goal 8), and thereby promote the School's ability to recruit and retain the best faculty (Goal 1), and to do the best research (Goal 3).

Identifying and Evaluating Alternatives

We considered three common models for organizing computing support services: the central academic computing center, the information center, and departmental computing.

- *Centralized academic computing:* the typical computer center provides services and systems for a wide population of users. Much of WCIT typifies this form.

- *Information center:* provides training, evaluation, and consultation to end users for a specific set of packages, typically microcomputer-oriented. WCIT also contains elements of the information center form.

- *Departmental computing:* computers and support personnel are located within the confines of the end-user department, and use is restricted to members of that department. Many Wharton academic departments have implemented some degree of departmental computing.

The staff associated with departmental computing is very similar to both that of the central computing and information center environments, except that there is typically more variability in the competence and quality of the departmental staff. There is usually also more turnover due to decentralized hiring and associated restrictions in career growth opportunities. It was evident to us that, due to the variety of faculty needs, departmental computing must continue to play a role in the delivery of research computing services. It was also clear, however, that improved mechanisms for ongoing communication between WCIT and departmental faculty would be essential for enhancement of research computing support.

We decided to modify our Research and Instructional Services unit, retaining a core of common support services provided by central staff, but deploying other consulting resources to academic departments. The innovative part of this design was the blending of the first model (central academic computing) with the third (departmental computing). The distributed component would consist of senior WCIT consultants who would be stationed in participating end-user departments under our continued management but with a joint funding arrangement with the departments.

Prioritizing and Re-linking to School Goals

There was little difficulty in confirming that this problem was high priority for it relates directly to three goals of the Plan for Preeminence and involves all four of WCIT's own Goal 1 subgoals, three of our five Goal 3 subgoals, and the second of our four Goal 9 subgoals.

Implementing Pilot Projects

Over the past six months, the distributed staffing component has been instituted in two academic departments (and three administrative offices). While the specific job descriptions and qualifications have been tailored to each case, five common elements define our basic implementation:

- Participation is voluntary. After an initial trial period, units commit to the remainder of the fiscal year, and on a fiscal year-to-year basis thereafter.

- Job descriptions are developed and candidates are selected jointly by WCIT and the participating departments.

- Distributed personnel physically reside in the user department office suite.
- WCIT holds regularly scheduled meetings, where attendance is required of distributed and central staff. These serve essential management and coordinative functions and expedite information sharing and diffusion of innovations among staff, and thereby, to clients as well.
- Under WCIT's general direction, distributed staff manage day-to-day allocation of efforts and resources. Overall prioritization of services, however, is determined by the department.

As the program expands, we expect some growing pains. More lead time will be required to recruit and train, because distributed staff need to be familiar with both the client office and WCIT itself. And span of control will become an issue as the program grows—we intend to address it with an internal promotion to management level at the appropriate time.

Making the Recommendation

We are recommending that the School adopt the distributed staffing plan for computing support, in both academic and administrative departments. The evaluation results demonstrate that the strategy meets key needs throughout the School: it is consistent with the organizational culture, and therefore is readily adopted—even demanded; it leads to higher productivity and lower total costs for participating departments and the School as a whole; and it contributes to key objectives of the Plan for Preeminence.

Marketing

In the pilot implementation stage, the program has not required any publicity or promotion—it markets itself through its own successes. To the extent that it meets the needs of participating departments and faculty, it builds its own demand within and across departments. Users and departments tell each other about the program, with the result that departments seek us out.

If the plan is formally accepted, we will market it cautiously, because too rapid expansion could jeopardize the quality of staffing and organization on which it is based.

Summary

So far in the preliminary implementation, all of our expectations and those of the participating departments and offices have been exceeded. In particular:

- More specialized support is being delivered to faculty,
- the flow of information to and from departments and faculty has improved,
- user requests are being expedited through the local consultant,
- local staff are benefiting from the professional development, backup, and continuity provided by our group, and
- turnover and attrition have been reduced among departmental technical staff.

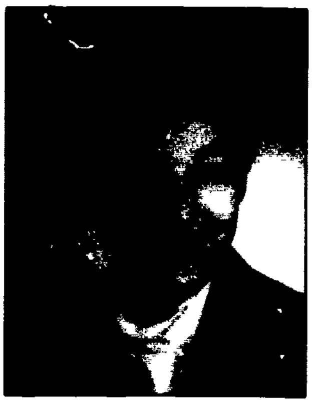
CONCLUSION

One can select from a number of good planning methodologies to structure a technology planning effort. Our particular selection works for us. The important issue, in our opinion, is not which methodology is chosen, but that a choice is made.

The plan must be properly communicated, and this requires a written plan statement. Even the best-constructed plan will not achieve its goals unless it is conveyed effectively.

Finally, the critical success factor in planning efforts is the degree to which the plan explicitly, or implicitly, links to the institution's goals. Linkage to the institution's goals addresses two key elements for planning success: achieving "buy-in" by members of the organization to the plan, and properly focusing on the issues of greatest importance to the institution.

Corporate Participation



Coordinator:
Dorothy Hopkin
Oakland Community College

Forty-five corporations with computer-related products and services participated in CAUSE88, through corporate presentations and workshops, sponsorship of conference activities, suite hospitality, and exhibits. A list of these corporations appears on the next page, followed by descriptions of some of their conference contributions.

Apple Computer Panel

Tony Allison
Business Systems Resources

Dana M. Bailey
Walker Interactive Systems

PARTICIPATING VENDORS

CAUSE appreciates the participation of the following corporations in CAUSE88:

- Advanced Micro-Electronics, Inc. (AME)
- The AIMS Group
- Aldrich Computer Services
- American Airlines
- American Management Systems (AMS)
- Apple Computer, Inc.
- AT&T
- Business Systems Resources (BSR)
- Campus America, Inc.
- Compression Labs, Inc. (CLI)
- Computer Management and Development Services
- Control Data Corporation
- Coopers & Lybrand
- Data Research Associates
- Datatel
- Digital Equipment Corporation
- Educational Data Center
- EDUTECH International
- Encore Computer Corporation
- Ernst & Whinney
- George Kaludis Associates, Inc.
- Hewlett-Packard Company
- IBM
- Information Associates
- Information Builders, Inc.
- Integral Systems
- John Grenzebach & Associates
- Kinetics, Inc.
- LaserMax Corporation
- National Car Rental
- New Jersey Educational Computer Network, Inc.
- Novell, Inc.
- Oracle Corporation
- Peat Marwick Main & Co./Nolan, Norton & Co.
- Prime Computer
- Quodata Corporation
- Relational Technology/INGRES
- Storage Technology Corporation (StorageTek)
- Sun MicroSystems, Inc.
- Systems & Computer Technology Corporation (SCT)
- Touche Ross & Co.
- University of Southern California Software Sales
- Walker Interactive Systems
- Wang Laboratories, Inc./Diversified Management International, Inc.
- Waterloo Microsystems

ADVANCED MICRO-ELECTRONICS (AME)

ADVANCED MICRO-ELECTRONICS (AME) wishes to thank everyone who stopped by to discuss their individual repair needs on personal computer hardware. **Congratulations** to **Steve Patterson** of the University of Minnesota for being the winner of the designer garment bag give-away.

Too many universities are wasting valuable computer boards and hard disk drives, thinking they are un-repairable or too expensive to repair. So **many of you** learned that's not true when you stopped by our booth.

After **your campus technician** has swapped out a bad part from a computer there is now a broken part. That's where Advanced Micro-Electronics comes in. Simply ship us that broken part and we will repair it within 4 days of receiving.

You can **stretch your budgets** by reusing those old bad parts; getting repairs back faster and not needing to stock as much; using flat rates designed to hold costs down; process faster by use of one service vendor, blanket purchase orders and not having to call-in before each shipment.

Skilled technicians and a friendly helpful staff are the **key to our success** at AME. Our lab is well equipped, complete with a class 100 clean room, allowing us to repair hard disk drives that would otherwise have been un-repairable.

Many **universities have already made commitments** to send stocks of parts they were ready to throw away.

Call AME at 812-422-4455 to see how we can help **improve the efficiency of your PC maintenance department.**

A FRESH APPROACH TO BUILDING STUDENT INFORMATION SYSTEMS

Fred Forman
Donna Morea
Andy Pickar
American Management Systems, Inc.
Arlington, Virginia

The challenges of data processing professionals in colleges and universities have grown dramatically in the last decade. While users at all levels maintain an ever increasing demand for both operational and strategic systems, data processing professionals must seek more efficient methodologies for developing these systems.

American Management Systems, Inc. (AMS), one of the nation's leading independent firms in applying computer and systems engineering technology to solve complex management problems of large organizations, is developing a Student Information System to provide colleges and universities with the most advanced software available to support the admission, financial aid, student records and student account functions. Many of the lessons which AMS has learned from development of the Student Information System and from the implementation of over 500 other major systems have broad applicability to any systems development and implementation effort.

The AMS Methodology employs five key points which help ensure successful systems development projects:

- o Top Down Design -- The Conceptual Approach
- o Select A Project Manager To Serve As Chief Architect
- o Analysts Must Have Vision
- o Keep Users Involved
- o Don't Take Too Long

Top Down Design -- The Conceptual Approach. With traditional systems development methodologies a project begins with a functional description of the new system using such techniques as data flow diagrams or functional decomposition charts. This process defines the system to a fine level of detail, usually including input and output formats, database specifications and detailed process specifications. Then the system design phase commences in which technically trained staff proceed to design the software and database components.

Unfortunately, regardless of the competence of the design team, this approach forces the design team to focus on a set of issues which should rightfully be examined at a later point in the process. By developing the specifications from a purely functional perspective, the project team has exposed the project to at least two problems that make large systems difficult to develop successfully.

First, by beginning with a functionality analysis, the myriad of details can become so mind-boggling that no one can see the legendary "forest for the trees." This situation requires a tremendous amount of coordination, and it virtually ensures the requirements will be misstated, misunderstood, or omitted. Second, specifying the functional requirements, then doing the design later increases the risk that the technical approach will have undesirable side effects. These effects do not appear until integration testing or live operation. Functional decomposition limits the opportunity to consider alternative designs early in the project.

In a "Top Down" design methodology, unlike a traditional life-cycle methodology, the key difference is that the system is designed before a detailed functional specification is developed. AMS's approach is to start with a System Concept so as to develop a complete understanding of the objectives and constraints of the system -- as opposed to the functional requirements -- and to define an overall design strategy. Then, within the context of the conceptual design, a detailed functional specification is formulated.

Select A Project Manager To Serve As Chief Architect. Another key factor in making this approach work effectively is to appoint a project manager who will also be the chief architect of the new system. A cohesive, integrated system will not just evolve from the osely coordinated efforts of the project team members. It requires that the design decisions be rmulated within the context of a consistent vision of the target system.

There must be a chief architect who provides that vision. That person must also have the authority to make binding decisions for the project, which naturally leads to the combined roles of the project manager as chief architect. The alternative, project manager as chief administrator (i.e., focused on form, not substance), is not workable.

Analysts Must Have Vision. As a direct result of beginning the systems development project with a conceptual design, the systems analyst must rise above the perceived handicap of working without a functional design. The analyst must bring a fresh, creative, but practical, vision of how to address the business problem effectively. The analyst must have a vision of future needs, not just today's. Also, the analyst must be able to understand the myriad of tradeoffs that occur in the design of a major system. Many of the "requirements" specified by users are not requirements at all. Under closer examination, many are simply "specifications" of how a system currently works.

Keep Users Involved. Some designers view user involvement as interviewing the users and managers during the analysis phase, then going off to design the system. The resulting design specification is then presented as a fait accompli for review and sign-off. Any hidden problems are simply postponed to the development phases, when it is an order of magnitude more expensive to fix.

There are simple ways to avoid these type of problems. The users must feel that the new system is their system, not the product of the MIS organization. Hence, they must have an ongoing, active participation in the evolution of the concepts and details that define the system, not just involvement at a few key milestone points.

Don't Take Too Long. Finally, for relatively large systems development efforts, it is important to limit the overall project timeframe to no more than about two years from project inception to production operation. Longer projects tend to lose focus (their scope starts to expand and shift), and it is difficult to maintain continuity of key personnel for the project's duration. For these and other reasons, longer projects rarely succeed.

Conclusion. Using this proven design methodology, AMS is in the process of developing a Student Information System which began with a Conceptual Design for a student system to meet the challenging and ever-growing demands of college and university administrators. This approach has ensured a fresh perspective for the design of integrated student systems for the higher education marketplace, rather than the design of a system which simply recreates existing systems. During the development of this product, AMS worked closely with four demanding but dissimilar clients: a major medical center, a large community college, and two traditional four-year universities. These institutions are: the University of Texas Health Science Center in Houston; Indian River Community College in Fort Pierce, Florida; Miami University of Ohio, and Ohio University.

AMS's Student Information System will be available for release early 1990.

Reference:

Forman, Fred L. and Hess, Milton S. "Form Precedes Function: Try a Design-First Approach for Strategic Systems Development." Computerworld, 5 September 1988, pp. 65-67.

Apple Computer Makes it all Fit at CAUSE88

Apple Computer participated in a variety of activities during the CAUSE88 National Conference. At the highest level, John Sculley, President and Chairman of the Board of Apple Computer, delivered one of the two keynote addresses for the conference on Thursday, December 1. During his speech, entitled "Transforming Information into Knowledge—the Challenge for the 21st Century," John discussed the enormous challenges that education, business, and government face in designing and managing complex multivendor information environments.

The keynote addresses of both Joe Wyatt, Chancellor, Vanderbilt University, and John Sculley were desktop published using Macintosh technology and delivered to all attendees the final morning of the conference. Following the CAUSE88 conference, a VHS videotape of Sculley's keynote address was made available to attendees.

Apple Higher Education Product Marketing Manager Van Jepson moderated a customer and national account presentation panel, "Managing a multi-vendor environment ". The panel, comprised of higher education administrators and corporate managers, discussed the technology and planning issues they must address in their institutions and businesses to ensure the success of their information management systems.

Apple Computer also participated in the first CAUSE88 Corporate Exhibit Area. At Apple's booth, university customers presented Macintosh administrative solutions for CAUSE attendees, including student information systems, executive support systems, and alumni development systems. Administrators from the following colleges and universities joined Apple to demonstrate their campus information management systems: Vanderbilt University, The University of Michigan, Washington College, California Polytechnic Institute at San Luis Obispo, Texas A&M University, University of Tennessee at Memphis, and University of the South.

Apple sponsored two hands-on workshops focusing on desktop publishing and HyperCard for all CAUSE88 attendees. Each workshop was repeated several times on Wednesday and Thursday. Attendees were able to experience first-hand the capabilities of the Macintosh computer in managing information with HyperCard and the power of bringing together text and graphics through desktop publishing technology to easily generate exciting and visually pleasing reports, presentations, and newsletters.

Apple brought a first to CAUSE88 conference attendees—a Macintosh Conference Information and Messaging System. Ten HyperCard Macintosh Information systems were located near the registration and exhibit areas to provide CAUSE88 attendees with an electronic messaging system to communicate with each other. As each attendee picked up his or her registration material for CAUSE88, they were directed to a video check–in area where a digitized photo was taken and fed into the Macintosh Information System. Attendees could then send messages and access other important updates on the conference program, in addition to learning about local Nashville events and activities.

A CAUSE Daily Newsletter—CHAT (CAUSE Has Apple Technology)—was produced by the CAUSE staff with Macintosh equipment provided by Apple Computer. Each newsletter contained highlights from the CAUSE88 conference, late breaking news and announcements, and schedule changes.

Apple also sponsored a dessert reception on Wednesday, November 30. The highlight of the evening was the innovative music of Kirby Shelstad. Using a MIDI interface with synthesizers and electronic percussion devices, Kirby performed to accompaniment provided by a Macintosh computer.

The dialogue between education and industry that develops at conferences such as CAUSE88 is very important to Apple. As the computing needs of higher education become even more complex, Apple continues to pursue and support strategic partnerships with leading organizations such as CAUSE to better understand how to make technology work for education and help information technology professionals plan for the future.

COMPREHENSIVE NETWORKING ON CAMPUS

JoAnne Conroy

AT&T

Bridgewater, New Jersey

AT&T offers a broad range of solutions which address campus data networking needs. This paper outlines those solutions with reference to network, type, size, connectivity and feature/functionality.

AT&T, a provider of comprehensive networking on campus, currently offers a family of networking products including; Virtual Circuit Switched (VCS) based LANs for both campus and wide area networks, Ethernet based LANs, a standard Premises Distribution system, an extensive array of voice systems, as well as integrated network management capabilities. These represent compatible, open standards based network solutions for the academic community which offer choices that meet a broad range of user needs.

For customers who require campus workgroup networking solutions, AT&T offers the Information Systems Network (ISN). ISN is a proven cost effective data network for customers with moderate to large data networking needs. ISN provides for asynchronous terminal and host access, remote concentration, STARLAN and Ethernet bridging capabilities, 3270 terminal switching as well as interpremise (synchronous and asynchronous) networking.

To meet the data networking needs of the Regional Bell Operating Companies (e.g. utility networking) as well as large corporate workgroup networks, AT&T offers DATAKIT II. Like ISN, DATAKIT II supports open standards and is based on Virtual Circuit Switch technology. The DATAKIT II product is a successor to the DATAKIT product and offers asynchronous/synchronous services, remote concentration, multiplexed host interfaces, Ethernet/STARLAN bridging, vertical services and can be integrated with ISN.

To meet customer needs for low to medium speed PC networks within a building or department, AT&T offers Ethernet based STARLAN and STARLAN 10. This approach to departmental workgroup computing is ideally suited for small to medium size networks.

The STARLAN product offering encompasses a full array of software options including; STARMAIL electronic mail capability, network management, synchronous gateway, asychronous gateway server, remote PC services and an X.25 gateway. For improved LAN throughput, individual STARLAN segments can be broken into smaller groups, and bridged using either ISN's Ethernet Bridging feature or STARLAN's desk-top bridge.

Addressing customer's distribution media needs, AT&T offers a standard distribution plan common to AT&T products which also addresses the requirements of other vendors wiring plans. The Premises Distribution System (PDS) is a plan which utilizes twisted pair wiring, optical fiber, and modular cross connect hardware.

AT&T also offers a comprehensive set of system and network management tools. These tools provide efficient management of resources by providing up to date data on traffic and performance monitoring to increase network up-time through early problem detection.

As technology continues to emerge AT&T will apply new solutions that meet marketplace needs. An example of emerging technology is the 802 standard Fiber Distributed Data Interface (FDDI). AT&T has made a statement of direction which signals our intention of moving toward this standard. FDDI will provide a 100 Mb/s Fiber based LAN where high speed, fault tolerant communications among LANs, high performance workstations and computers are required.

In closing AT&T's Data Networking Products provide the solutions to meet your campus networking needs today and in the future.

AT&T

BUSINESS SYSTEMS RESOURCES, INC.

Abstract of a presentation at CAUSE88

In a vendor presentation at CAUSE88, BSR's Tony Allison, Vice President, discussed BSR's experiences to date with the implementation of **Advance**, BSR's alumni and development system, using the IBM SAA (Systems Application Architecture) environment and IBM's relational SQL/DS database. Mr. Allison was joined in his presentation by Mike Pennington, Advisory Systems Engineer, of IBM, who described the key components of IBM's SAA and reviewed the benefits of SAA. SAA is IBM's framework for the development of consistent applications across the major IBM computing environments, including the System/370, AS/400, and PS/2 product lines. Major benefits of SAA include enhanced programmer and user productivity and enhanced ease of use and support with consistency across applications.

At BSR's vendor exhibit and suite at CAUSE88, BSR demonstrated **Advance**, the most comprehensive system available for institutional advancement. **Advance** is designed to support the needs of the largest and most demanding development organizations. On-line features include maintenance and inquiry of extensive biographical data and relationships, entry of pledges and gifts, full giving history, and support of major prospect tracking and campaign management functions. Interfaces with accounting systems and word processing are supported. Exceptionally easy to use, **Advance** features a menu structure for selecting functions, a powerful name lookup function for persons and corporations, and powerful query facilities for ad hoc reporting. **Advance** versions are available for both IBM mainframe and Digital VAX computers.

Campus America

College and University Data Processing Systems and Services

CAMPUS AMERICA, INC.
PARTICIPATES AT THE CAUSE NATIONAL CONFERENCE

By Cathy Jackson

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Regency Business Park
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(615) 523-9506

Campus America, Inc. was pleased to contribute to the CAUSE National Conference as a corporate exhibitor. Participation included a demonstration of POISE, (People Oriented Information Systems for Education) administrative software integrated with Digital Equipment Corporation's All-In-1 office automation software. A breakfast hosted by Campus America for subscribers and other interested members gave the conferees an opportunity to assemble and share information.

Campus America and Digital Equipment Corporation's commitment to higher education was exhibited in the corporate demo area at CAUSE88. Demonstrations were shown of a campus-wide computing network, including POISE (People Oriented Information Systems for Education) administrative software integrated with Digital's All-In-1 office automation.

Campus America was selected by Digital Equipment Corporation to join their Systems Cooperative Marketing Program (SCMP). This agreement reflects Campus America's commitment to current technology as well as its involvement in the planning of new generations of systems and services. Becoming a Digital Systems Cooperative Marketing participant in higher education complements Campus America's already-strong position as a leader in providing feature-rich products and services to colleges and universities.

A breakfast meeting was held for users and other interested CAUSE members. Jeff Jones, National Sales Executive, reported on Campus America's accomplishments and contributions to higher education for 1988. With a 36% growth in 1988, the company continues to be a premier supplier of software and services to colleges and universities.

Jones announced Campus America's new VAR agreements with WordPerfect and also Moore Business Forms. As a value added reseller for WordPerfect, POISE will be offering an interface to enhance the use of WordPerfect with DMS-Plus and POISE application software. Through a cooperative business forms program with Moore Business Forms, Campus America will develop an offering that meets the specific needs of Campus America subscribers while reducing the cost of forms.

Jones said some new products to look for from Campus America in 1989 are a Personnel System and a Telephone Registration System.

It was also announced that "CampusWorld", the higher education newsletter from Campus America, will continue to report and highlight products and services to the education marketplace.

Computer Management and Development Services (CMDS)

CMDS, a leading developer and marketer of administrative software for higher education, demonstrated its popular Total Educational Administrative Management System (TEAMS) software at CAUSE88. TEAMS is composed of applications modules for admissions, registration, advising/degree audit, financial aid, accounts receivable/payable, student loan, institutional cost analysis, development/alumni, payroll, and general ledger. All modules are integrated and interface with TEAMMATE, a proven, flexible, and user-friendly data base manager.

As a highlight of its exhibit, CMDS ran TEAMS on IBM's new AS-400 midrange computer system. CMDS, which is an IBM Industry Application Specialist, also offers TEAMS for the IBM System 36. CAUSE88 participatants who stopped by CMDS's booth found out why more than 200 college and universities have streamlined their administrative functions with TEAMS.

CONTROL DATA

The Control Data Transparent Computing Environment™

Imagine a futuristic data center filled with advanced computers and inventions of the next century, surrounded by the crystalline walls of science fiction A center that distributes processing resources on the basis of individual need and dynamically changes the processing power brought to bear on problems in accordance with user requirements A center that shows a common face to every user, regardless of the hardware and software assigned to address his problems

Well its not science fiction any more Control Data's Transparent Computing Environment can provide this capability today

The Transparent Computing Environment is more subtle than any single operating system, data base manager, or language compiler, more powerful than processors, input/output channels, or memory components It is an environment that allows you to tap the level of processing power appropriate to your needs, processing power to efficiently solve problems and run applications without worrying about the source of the power or the inconvenience of learning new procedures And to access this power without regard to whether you are running on a desktop workstation, departmental machine, mainframe, or supercomputer

Control Data's Transparent Computing Environment encourages departments to integrate their information with others and to distribute it to everyone in an organization who needs it It doe n't matter whether staff use workstations, PC's or intelligent terminals or whether the computers used to support user tasks are manufactured by Control Data or someone else -- Control Data can provide you with the products and tools to create your own Transparent Computing Environment

The Transparent Computing Environment answers your need for more computing power, data integration, inter-work station connectivity while providing the flexibility to choose the solution that maximizes your organization's productivity

Control Data designed the Transparent Computing Environment to serve in a world of specialized applications Its foundation is based upon decades of Control Data experience in scientific, engineering, and administrative computing and its architecture provides integrated computing solutions for all of higher education's computing needs

The Seamless User Interface

The real power of the Transparent Computing Environment is not the part you can visibly see but the parts you can't When your work requires more resources than a desktop processor can provide, Control Data offers a variety of desktop and operating system interfaces that help you tap the power of remotely located computing resources you need, when you need it

Desktop interfaces enable personal computer and workstation users to access more powerful systems through commands they already know For example, Desktop/VE gives Apple Macintosh™ users the ability to easily run CYBER-based applications on mainframes in a familiar manner using icons, windows, pull-down menus, mouse operations and dialog boxes

Our VISTA product suite allows PC users to manipulate CYBER-based data with a user interface they already know from Lotus 1-2-3™, Symphony™ or dBase™ Using this interface permits users to access data residing on CYBER computers and merge them with PC-based applications

A variety of operating system interfaces accelerate the learning and productivity of new CYBER users by providing them with a command and editing language they already know

One such interface is VX/VE, a UNIX™ shell that gives anyone versed in AT&T System V UNIX the ability to develop and execute UNIX-based applications on Control Data CYBER systems

Officeware allows your text processing, spreadsheet analysis and business graphics applications to coexist on personal computers and CYBER hosts

The Eden suite of administrative applications -- Student Records, College and University Financial, and Human Resource systems -- supports *ad hoc* reporting on either the CYBER mainframe, or one a personal computer via simple, English language commands A powerful system control language, (SCL) enables users to manipulate data, establish job stream schedules, and manage application development within a single environment

All of these interfaces can work transparently on desktops throughout your organization, thereby permitting users to concentrate on solving problems rather than the mysteries of your system

The Multivendor Connectivity -- The Global View

The Transparent Computing Environment wouldn't be as useful if it supported only Control Data systems That's why, from the very beginning, we have insisted on offering transparent computing for multivendor environments Our networking products feature an open systems architecture that accommodates industry standards, as well as *de facto* standards such as TCP/IP The Transparent Computing Environment and its associated Control Data networking products help you open pathways between all your systems, without regard to vendor

The Control Data product line -- the most complete in the industry -- allows your various departments to integrate data and immediately distribute it to those in your institution who need it With Control Data you can.

- Spend less time making your computer system work and more time working
- Efficiently solve problems or run applications without worrying where or how the processing is done
- Continue to use the operating commands you already know to reach all levels of processing power

Focusing our efforts towards providing solutions for your complex needs, Control Data continues to provide high performance computer systems for the scientific, technical and information markets Control Data offers integrated solutions tailored for the higher education environment Control Data answers your need for more power, integration, standards, connectivity and growth We give you the flexibility to choose the best solution

For more information on the Transparent Computing Environment contact your local Control Data sales office or:

Quin E Hahn
Control Data Corporation
8100 34th Avenue South -- HQC01P
Bloomington, MN 55425-1640

Coopers & Lybrand

SUMMIT-S

EXECUTIVE SUMMARY

SUMMIT-S has been described as a "comprehensive" and "flexible" methodology, which can be widely applied to varying circumstances. This is achieved because the basic methodology is designed and built in a well structured manner.

This structuring has been approached from two angles. First, the methodology itself, in terms of the phases, modules and tasks, conforms to a clear structure and, second, the products and deliverables generated by those phases, modules and tasks assume a structure of their own. These two structures are clearly interrelated.

METHODOLOGY STRUCTURE

SUMMIT-S is designed to manage the work effort of an information systems planning project through a process-oriented work breakdown structure of phases, modules and tasks. This structure has a number of important features as follows:

- Phases, modules and tasks are clearly defined work steps, with procedures and prerequisites across phase and module boundaries highlighted with recommended client and consultant involvement in each work step;
- Review points are established at the end of each phase and module, indicating the levels within the client organization at which such reviews should take place; and
- Recommendations for action are created for consideration at each of the major executive review points.

PHASE SUMMARIES

In overview, the five major phases are:

- Phase 1 - Strategic Positioning - A brief, top-level strategic review to establish how senior client executives and the consulting team perceive the current position and potential direction for Information Technology (IT). Phase 1 is the key direction setter for the rest of the study and a means of focusing the attention of management on major IT issues and the current and potential contribution of IT to the business;
- Phase 2 - Business Opportunities - The major business-oriented phase of the methodology, Phase 2 concentrates on developing a clear focused view of the business requirements, opportunities and priorities for IT and suggesting ways in which IT can contribute positively to the improved efficiency and effectiveness of the organization;

- Phase 3 - IT Assessment - A high-level diagnostic review of the current IT environment to assess effectiveness and efficiency and to establish the extent to which it provides a base for the future;

- Phase 4 - IT Architecture - The most technical phase of the methodology, combining technical skills and business judgement to develop IT solutions to meet the business requirements. This phase focuses on the identification and evaluation of options to develop an IT strategy which is technically advanced, provides practical solutions and is feasible and cost-effective to implement; and

- Phase 5 - Implementation Bridge - The vital link between planning and implementation, developing project plans and initiating change in support of the future use and management of IT by the enterprise. This phase provides the key interface with SUMMIT-D, our methodology for systems delivery.

REVIEW POINTS

Each module and phase closes with a client review point, where the client, at a specified level within the management structure, reviews, comments and, in some cases, approves the results of that module or phase.

There are five major review points, executive reviews, which are conducted at the end of each phase (plus an interim review during Phase 2) with the client's executive review team. These are key decision points in the study, when the client is presented with the study team's conclusions and recommendations and asked to make decisions regarding the next stages of work.

RECOMMENDATIONS FOR ACTION

At each major review point in the methodology, recommendations for client action are produced. These range from recommendations to major issues which may require immediate action by the executive team to detailed implementation plans which will be transmitted to development project teams upon completion of the study. In all cases, these recommendations are delivered in response to immediate needs, recognizing the realities of the short-term during which operations must continue while the long-term strategy is implemented. These recommendations for action are defined as major client deliverables.

DATATEL

Datatel

Datatel showcased its two major computer systems, Colleague® and Benefactor®, at the 1988 CAUSE Conference. Both are information management systems that automate the time consuming tasks that can hamstring the effective administration of colleges and universities.

Colleague, a multi-faceted system that extends the processing of information to virtually every department of an institution, has been carefully crafted to meet the needs of today's administrator. It is a mature product that enjoys the benefit of nine years of evolutionary improvements resulting from Datatel's experience in the higher education marketplace.

Benefactor is a new Datatel product that supports alumni development activities. This system is comprehensive in scope and features advanced display techniques and computer-directed access to critical alumni and activity data.

Both Colleague and Benefactor feature a relational-type data base and a user-oriented query language. These features give the end user the ability to access every element in the data base. To those accustomed to more traditional data processing systems where programs or reports have to be generated by the "DP" department, this offers a new element of freedom and control. It gives decision makers the ability to access and manipulate the information they want, when they want it.

Colleague has 21 separate software modules that automate recruiting, admissions, registrar, records, grades, transcripts, financial aid, accounts receivable, accounts payable, inventory, fixed assets, payroll, and personnel to name just a few. The Colleague system has been installed at over a hundred institutions in the United States. Datatel demonstrated its latest release of Colleague that featured the new Degree Audit and Correspondence Control modules. Degree Audit provides all the tools needed to track a student's academic progress and allows for a wide range of "what if" analysis to explore alternative degree paths available to students. The Correspondence Control module provides the user unlimited flexibility to assign and alter prescribed communication "tracks" to individuals or groups while automatically building history of all types of contacts. An integral part of Correspondence Control is its interface to the Colleague WP system or the office automation system.

Benefactor, Datatel's fund-raising system for higher education, was well received by conference attendees. Benefactor contains modules for individual donor information, organization information, gift and pledge processing, correspondence management, major donor tracking, planned giving, activities and events, campaign management, proposal management, and membership processing. Benefactor's advanced display and screen handling techniques drew a lot of attention at the conference. These include extensive use of function keys, nested multi-level windows, direct access functions for pertinent data, comprehensive "help" functions, and computer decision making based on user specified parameters.

Datatel, which is celebrating over 20 years of business, is looking forward to another active year in the higher education field and in its valuable association with CAUSE. If you'd like to know more about our company or our products, please call Bill Petersen (703) 968-9000.

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DIGITAL EQUIPMENT CORPORATION AT CAUSE'88

ANNOUNCEMENT OF "THE EDUCATION INITIATIVE"

More than 500 CAUSE'88 registrants attended Digital's announcement at a Wednesday morning breakfast meeting of a comprehensive new program, "The Education Initiative." Below are highlights of the announcement by Roger Strickland, Education Marketing Manager.

"Today I'm going to introduce a new kind of partnership program --the most significant and far-reaching program that Digital Equipment Corporation has ever offered to the education community. The Education Initiative is a comprehensive set of programs that will make technology far more affordable and available to faculty, students, and administrators throughout your institution.

"These programs are innovative approaches to site licensing, software support, and hardware self-maintenance. We're asking educational institutions to share certain responsibilities with Digital. The result is substantial savings to you.

"The first program, **The Campuswide Software License Grant Program**, is certainly one of the most exciting we've ever offered to education. We are granting more than 160 Digital software licenses at no charge to educational institutions. This is an unprecedented offer.

"This grant covers nearly all Digital's non-royalty layered products plus the VMS operating system and the ULTRIX operating system for schools that have (or are willing to procure) the AT&T site license for UNIX. Unlike other grant programs, Digital's allows you to use the software for any function--administration, research, instruction, or MIS.

"The Campuswide Software License Grant program is a partnership agreement. In turn for the license grants, we're asking schools to set up a central resource for managing the licenses, tracking them and reporting to us on their use.

"There are a few products that aren't covered by this grant but are important to the education community. We're offering these licenses through our **Education Market Basket** program. Software in the market basket includes products for which Digital must pay a royalty fee and products for personal computers. These licenses will be made available at about 75% off commercial list price.

"Through a third program, our **Education Grant Program** we're offering grants for Digital computer systems preconfigured with systems software, including including the VMS and ULTRIX operating systems, DECnet, and VAXcluster software. Every time you buy a new Digital system with this software packaged in, you'll receive an associated grant, depending on the size of the system.

"Another major cost to educational institutions is in software maintenance and support. To address this issue, Digital developed a pioneering program, the **Education Software Library**. Now the Education Software Library has been expanded to included both low- and high-end systems and reshaped to reduce costs even further.

"The Education Software Library offers support for a portfolio of products that are the most widely used Digital software in the education community--including the VMS and ULTRIX operating systems and more than 40 layered products.

"Your role in this partnership is to establish a central site on campus to manage this portfolio. The central site handles purchasing, distribution, and first-line support of users. In turn, Digital provides initial media and documentation, updates, and direct access to senior software support specialists For a campus that has at least 25 Digital systems that support the VMS or ULTRIX operating systems, the Education Software Library results in tremendous savings in software maintenance and support.

"Another expense that greatly adds to an institution's long-term cost of ownership is hardware maintenance. We're offering a new self-maintenance program, the **Campus Service Agreement**, to share some of those expenses and pass the savings on to you.

"As in our other partnership programs, we ask the customer to set up a central resource--a technical assistance center to handle initial on-site labor. Digital provides all the products and services essential to successful self-maintenance, and provides backup technical specialist support on an as-needed basis. The monthly fee for this program is about 75 percent less than Digital's standard comprehensive on-site service agreement.

"The Education Initiative represents a whole new way of doing business with education. We based these programs on <u>your</u> needs as <u>you</u> expressed them through focus groups and market surveys. Through these programs, Digital is saying, we are committed to the education market; we intend to invest in education, not just for the moment, but for the long run."

Encore Computer Corporation Exhibits at CAUSE

Encore Computer Corporation of Marlborough, Massachusetts exhibited its Multimax™ parallel processing system at CAUSE '88 in December.

Encore is one of the fastest growing firms in the nation today[1], and is becoming a familiar face among the list of computer vendors with proven products, performance, and a commitment to solutions for higher education. As a firm that designs, manufactures and markets a family of advanced computer systems, Encore offers the kind of UNIX-based computing solutions -- and price/performance value that ins ..utions need today.

Using an implementation of both multiprocessing and parallel processing, Encore Computer offers the benefits of mainframe performance at workstation prices. The Encore Multimax parallel processing system offers from 4 to 170 MIPS of computing power that is processor-upgradeable. The user simply adds memory and/or processor boards to the Encore system as the number of users or applications increases -- with an almost linear performance increase.

More importantly, Encore is college and university-proven. We are in the campus computer centers, business offices, science departments and parallel processing research labs of almost 100 college and universities worldwide. Almost 40 percent of our installed base is in educational and research institutions.

Encore is strong in Education in part because of our adherence to standards. The Multimax runs on the UNIX operating system, using our version of either UNIX™ 4.2 bsd or UNIX System V.3.1., and communications to local area networks and other devices via Ethernet™ TCP/IP. The Multimax also supports NFS and is a superior file server in Sun™ networks.

Encore also offers a wide range of readily-available solutions for institutional computing needs:

- o Research and Academic Tools -- parallel languages and tools like Parallel Fortran and Parallel Ada; statistical packages and parallel mathematics libraries such as PCGPAK™; and structural analysis packages like NISA™ and Abaqus™.
- o Office Management -- with several word processing packages including WordPerfect, a user-friendly UNIX interface called MAXuser, office automation from Quadratron, and the popular 20/20 spreadsheet from Access Technology.

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[1] As listed by INC, May 1988

- Administrative Computing -- with software like CARS
- Relational Databases -- including INFORMIX^{tm}, Oracle^{tm} and Ingres^{tm}

Encore's Multimax systems also present outstanding price/performance values, whether quantified by price per active user or price per student. Because of Encore's implementation of multiprocessing -- applying up to 20 industry-standard microprocessors to work on different programs -- and parallel computing -- applying those many processors to work on many tasks within a single program simultaneously, Encore can offer the equivalent of other vendor's costly systems at a significantly lower price.

Of particular interest to educational institutions is Encore's VAX^{tm} to MAX Trade In Program. With a simple, transparent swap, Encore will allows the user to trade a VAX 750,780, 785 or other VAX for the lease of a new, fully-warranted Multimax system. Even at the entry level configuration, the end user will receive up to four times the processing power -- with future upgrades assured -- often for less than the cost of DEC maintenance ALONE.

That translates to FREE MIPS (millions of instructions per second) -- and the power of a new age of computing -- for less than one would expect.

Whatever the application, Encore Computer can offer educational institutions the computer technology that has been recognized as the future of all computing. Since its founding in 1983, Encore has pioneered the practical application of parallel computing to real-world solutions. Our Multimax systems take advantage of the latest in microprocessor technology and software advances to create a system that grows as the institution grows to provide:

- faster computing speeds and response times;
- better price/performance ratios;
- an almost linear speedup in response times as the number of processors increases; and
- an almost unimaginable ease of upgrades.

Hardware upgrades, whether to successive generations of processors or just to new memory, are as simple as swapping boards in and out of a cabinet -- at a fraction of the cost of a new system.

Encore was pleased to exhibit its products to the higher education institutions present at CAUSE in Nashville and looks forward to exhibiting again next year in San Diego.

Ernst & Whinney

And *results.* They go together.

Information Systems Planning

Presentation
by:
Thomas E. Long
Principal
Ernst & Whinney

2000 National City Center
Cleveland, Ohio

Information Technology Planning requirements today vary too greatly for one process to meet all needs. An important job for systems planners is to understand the characteristics and merits of a wide variety of alternatives, and then to select and tailor different approaches for use where they will be most appropriate. Adapting planning efforts dynamically to needs which change from one part of an institution to another and over time can create true linkage between business and technology strategies.

Senior Information Systems executives must facilitate the planning process by understanding recent developments in strategic information systems planning.

All new information system planning approaches are focusing on key concepts as follows:

1. Strong linkages must be formed between general management and systems management.
2. The planning process must follow a constructive change management sequence of shaping and supporting.
3. An institution must be able to focus planning on issues which are relevant and timely.
4. Alternative techniques are needed to accommodate a hierarchy of business needs.
5. Planning topics and focus vary by level of institutional management.

The ideal methodology is a flexible, but coordinated approach to systems planning that:

- Builds on strengths of the classic approaches
- Adds crucial element of modularity
- Accommodates new issues as they surface
- Links systems management to institution management
- Produces practical results

Strategic information systems planning is becoming recognized as an essential process required to effectively manage the increasingly complex technology solutions available today and in the future.

Systems planning began by tracking expenditures over time, in response to needs to understand and control costs. Many traditional approaches and methodologies evolved.

Business Systems Planning added a data infrastructure pyramid including planning, control, operations and data resources.

"Data" became the key resource. Planners attempted to manage and control data.

Critical Success Factors Planning focused on the top layers of planning and control. Critical success factors shifted the focus from operation automation to providing information for management. The concept was to define "things which must go right" and then provide information to track success.

External forces such as student demands, other institution actions, and information technology suppliers have undermined traditional frameworks. However, some lessons from traditional approaches should be retained and adapted, such as:

- The need for top management involvement and commitment
- Business modeling and decomposition
- The need for integrated architectures
- Change management sequence
- Linkage to general management strategies and goals
- Operating information systems function as a business
- Management disciplines
- Information is a corporate asset
- Organizations have similar needs and experiences

New information age issues also must be resolved, including:

- Office automation
- Distributed computing
- Telecommunications
- Competitive advantage
- Inter-organizational systems
- Organizational design

A variety of new approaches are evolving, but no information systems planning panacea is appearing due to:

- Different levels of awareness and sophistication
- Needs vary significantly
  - Between enterprises
  - Within enterprises
- New tools and techniques are more issue oriented
- Many organizations "inoculated" against comprehensive information systems planning efforts

GKA

CAUSE88

GKA's participation in CAUSE88 involved sponsorship of the Wednesday morning coffee break and a Track IV: Organization and Personnel Issues presentation, **Putting the "Service" back into Computer Services: Organizing Computing for the Successful Delivery of Services,** on Thursday morning by Senior Associate John F. Leydon, who co-presented with Betty Le Compagnon, Executive Director of University Computing, University System of New Hampshire.

Company Profile

GKA is an executive consulting and management services firm specializing in support to higher education. Since its founding in 1977, GKA has assembled a cadre of senior professionals with first-hand experience as executives and technical specialists in universities and colleges. GKA has a strong record of success in supporting institutions and their executives in managerial and technical areas, and has developed a reputation as a firm composed of strategic thinkers and creative problem solvers who go beyond a simple prescription to join with clients in preparing for and implementing change. In the past two years, GKA has aggressively expanded its telecommunications and information systems staff to meet higher education's growing demand in information technology.

Involvement in Higher Education

The core of GKA business has always been service to higher education institutions, executives and governing boards in a broad range of areas: transition support, strategic planning support, organizational evaluation, executive recruitment, software and hardware consulting, telecommunications consulting, project management, and interim management. A representative sample of GKA's diverse clients is presented below:

- Brandeis University
- College of William and Mary
- Columbia University
- Drew University
- Duke University
- Eastern Virginia Medical School
- Fairleigh Dickinson University
- Indiana University System
- Massachusetts Board of Regents
- Meharry Medical College
- Mt. Holyoke College
- New York University
- St. Louis University
- Union Theological Seminary
- University of Delaware
- University of Maine System
- University of Medicine and Dentistry of New Jersey
- University of Missouri System
- University of Pennsylvania
- University of Texas Health Science Center at Houston
- University of Texas M.D. Anderson Cancer Center
- University System of New Hampshire
- Washington University
- Wayne State University
- Western Carolina University
- Westfield State College

GKA

Range of Services

Advancing technology is altering the way institutions collect, store, analyze, disseminate, and use information. University and college executives face an increasing array of technology-related challenges. GKA combines technical expertise and management know-how to support the design and implementation of effective information technology solutions. GKA's Information Technology service portfolio encompasses:

Evaluation and Planning
Operations Appraisal
User Requirements Analysis
Internal Plan Review
Strategic Plan Development

Procurement and Implementation
Computer/Telecommunications System Design
Systems Integration
RFP Preparation/Evaluation
Vendor Negotiations
Project Management

Network Planning/Long Distance Service Analysis
Performance Appraisal
Topology/Technology Design
Cost/Performance Optimization

Specialized Services
Office Automation/Cabling Analysis and Design
Facilities Programming
Interim Management/Recruitment
Business Opportunities Evaluation

For additional information, contact:

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IBM CORPORATION

IBM is pleased to have participated in the 1988 CAUSE Conference held at the beautiful Opryland Hotel in Nashville, Tennessee. Through this participation, we hope to further demonstrate our commitment to and continuing interest in higher education.

It was our special pleasure to have sponsored the Thursday evening "Country Christmas Feast and Musical Revue." The Opryland Hotel, decked out in all its seasonal finery, was the perfect setting. The spirited and talented singers, dancers and musicians complimented the evening with a superb performance.

The IBM exhibit booth featured demonstrations on the new IBM AS/400 and the IBM Personal System/2. IBM representatives were on hand to answer individual questions and to provide information on the entire line of IBM products and services. IBM's business partners, Information Associates (IA), American Management Systems, Inc. (AMS), Systems and Computer Technology Corp. (SCT), and Computer Management and Development Services (CMDS), displayed their individual company software, illustrating how IBM is increasing the number of options available to address administrative needs.

Additional information about IBM and its products was available at several scheduled sessions. The Constituent Group Meeting, led by California Polytechnic State University, discussed the IBM Higher Education Software Consortium (HESC). IONA College representatives related their experience with "ConnectPac", developed under an IBM/IONA joint study.

INVOLVEMENT IN HIGHER EDUCATION

IBM's commitment to higher education is expanded beyond the areas of research and academia to address administrative computing needs, making us a participant in the total campus environment. As the leading supplier of computing hardware to school administrations, we recognize that higher education, faced with ever increasing costs and declining enrollments, must strive to make most efficient use of its physical, capital and intellectual assets. Computing and technology are part of the solution. Improved scheduling and enrollment, campus networking, on-line office and administration systems, and accurate and timely completion of academic and administrative information processing reduces operating costs while enhancing the institution's ability to attract top faculty and students. IBM is proud to be a partner in this critical effort.

In 1983, IBM formed Academic Information Systems (ACIS), to be the corporate focal point in higher education, and to provide leadership in computing in the areas of research, instruction, and academic and administrative support. ACIS's role is: to broaden IBM's technological and product presence on campus and in all departments and disciplines; to strengthen IBM's reputation as a preferred vendor by providing advanced technology and products; and to provide the leading products, support and service to higher education.

PRODUCT SOLUTIONS

An example of IBM's focus on administrative computing is the recently announced IBM Application System/400 (AS/400). With its advanced capabilities, and a variety of applications solutions, the AS/400 can help campus administrators stay competitive, improve services, streamline administrative tasks and expand to meet changing information systems needs.

The AS/400 offers:

* the ability to implement a wide range of easy-to-use administrative applications, including many designed by colleges, universities and other software vendors.
* an exceptionally productive application development environment.
* easy migration from the IBM System/36 and System 38.
* growth potential to handle future needs.
* a state-of-the-art relational data base integrated into the operating system.
* a superior level of connectivity between the IBM personal computer and the AS/400.

Other available products and programs include a series of Office Systems application solutions strategically positioned to link campus computing with the office system. Through this melding of traditional office tasks with the power of mainframe computing and data storage, the office workstation is now capable of participating in a wider and more effective menu of tasks.

COOPERATIVE STUDIES ENHANCE ADMINISTRATIVE PROGRAMS

IBM and Information Associates, an IBM Industry Applications Specialist (IAS), are working in cooperation with the California State University System to implement DBase 2 software in the Information Associates application programs.

A study is currently underway between IBM and the National Association of College and University Business Officers (NACUBO) to analyze and enhance the ability of the IBM AS/400 in addressing the needs of university business officers.

INDUSTRY APPLICATIONS SPECIALISTS

IBM has entered into a cooperative marketing agreement with several business partners designated as Industry Applications Specialists (IAS). IAS provide sales, installation and application support on a regional or national level. Most install their own software, covering application niches for which IBM does not have application solutions.

The current list of IAS's includes:

* NOTIS (library systems)	Evanston, IL
* IA - Information Associates	Rochester, NY
* SCT - Systems and Computer Technology	Malvern, PA
* Champlain Software	Burlington, VT
* Kirkwood Community College	Cedar Rapids, IA
* CMDS - Computer Management and Development Systems	Harrisonburg, VA
* AMS - American Management Systems	Arlington, VA

CONTACT

For more information about IBM, its products, services and programs, contact your local IBM office, or write to:

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472 Wheelers Farms Road
Milford, CT 06460

Information Associates

INFORMATION ASSOCIATES UNVEILS NEW POSITION, SHOWCASES STRATEGIC ALLIANCES

At a gala reception Wednesday evening, November 30, Information Associates made the first public announcement of its new position statement: "Technology As Power . . . Unlocking the Promise of Higher Education."

Integral to the central direction of the company as the solution builder for higher education is the creation of strategic alliances with other industry leaders. Information Associates seized the opportunity of CAUSE88 to showcase several alliances with representatives present at the conference:

APPLE COMPUTER

As part of the OASIS project, California State Polytechnic University, in cooperation with Apple Computer and Information Associates, is currently developing an Apple Macintosh II® version of one module of IA's Executive Support System. The scope of the project is limited to the Workstation Support Software Module. Developers Darren Giles and Michael Morgan of Cal Poly demonstrated the Macintosh II ESS/WSS prototype in the Apple Computer exhibit.

DIGITAL®

Information Associates' Series Z® and Digital Equipment Corporation's ALL-IN-1® -- the integration of these two proven software products offers customers unsurpassed convenience and an ability to increase productivity.

From a single workstation capability, to common user interface, to the incorporation of "live" data into document processing, the Series Z/ALL-IN-1 integration brings it all together.

IA has developed the new composite software product with digital VAX computer systems, maintains the new Series Z for users, and has created complete documentation and training materials.

IBM®

The On-Line Administrative Student Information System Project was announced at CAUSE87. A year later OASIS partners Information Associates, IBM, and California State University report notable progress on the project.

The comprehensive student information system under development will enable three CSU campuses -- California Polytechnic State University, San Luis Obispo; CSU Los Angeles; and CSU Long Beach -- to store all student information in a sophisticated database that is easy to update and access. The project includes the initial installation of IA's standard version of SIS and the subsequent installation of a new version of SIS running on IBM's DB2® relational database.

INFORMATION BUILDERS

Information Builders, Inc., (IBI) announced the appointment of Information Associates as its first higher education Industry Remarketer. As an Industry Remarketer, Information Associates offers its users an integrator module that allows IBI's FOCUS to run against IA's complete line of Series Z software. The IA/FOCUS Integrator forms the interface between IA data and FOCUS and enables users to generate FOCUS reports using data from IA systems.

RELATIONAL TECHNOLOGY

Relational Technology Inc. and Information Associates announced a three-year partnership agreement. Valued in excess of $2 million, the agreement allows IA to distribute Relational Technology's INGRES products, including INGRES Gateways, to administrative customers in higher education.

Information Associates' current plans include development with an INGRES toolset. This development effort is in progress, and IA is actively recruiting customer partners to participate in development and field testing. The appeal of INGRES for IA clients is its powerful and sophisticated capability to access and communicate among many hardware environments, particularly Digital and IBM.

SUN MICROSYSTEMS

Sun Microsystems and Information Associates announced an agreement to port IA's Series Z higher education administrative computing systems for student information, financial records, human resources and alumni/development to run on the Sun-3* workstations. IA is now a member of Sun's Catalyst Advantage program of third party vendors.

Aimed at the UNIX market, the Sun/IA solution will be an affordable, expandable system supporting distributed databases and data processing across a networked computing environment. Sun's interconnectivity products, such as its TOPS* network software and the Sun IPC* PC emulation board, allow users to inexpensively access existing DOS and Macintosh software. Sun will be the first UNIX vendor to support the IA solution.

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INTEGRAL SYSTEMS

CAUSE88

This year's conference was a major success for Integral Systems. We sure hope that CAUSE88 was as productive and rewarding for you as it was for us.

Of course, this year's conference was extra special since it was held at the fabulous Opryland Hotel. Hopefully you were able to stop by our hospitality suite on either Tuesday or Wednesday night and enjoy the wonderful food and beverage. In addition to the fun, suite attendees were able to learn more about Integral Systems' Human Resource Management System.

A special thanks to our many existing clients who stopped by to visit.

COMPANY PROFILE

Integral Systems has been dedicated exclusively to human resource software development for 16 years. With 300 employees working out of eight offices across the U.S. and Canada, the firm offers a full range of human resource software along with high quality product training and consulting.
Integral Systems spends significantly greater than the industry norm on research and development, thus assuring that its software is technically innovative and based on the very latest data base technology (including DB2).

INVOLVEMENT IN HIGHER EDUCATION

Integral Systems was originally founded in 1972 as a developer of human resource software for institutions of higher education. Consequently, the company's software was designed and based upon higher education needs. Even in its expansion to other vertical markets, Integral has continued to recognize the special needs of the academic community and has continued to aggressively support those needs in its products.

PRODUCTS AND SERVICES

Integral Systems' products cover the entire spectrum of Human Resource Management. Products include: Personnel Administration, Payroll Management, Flexible Compensation Administration, Pension Benefits Administration, Position Control, Applicant Tracking, Compensation Planning and Analysis, Succession Planning, Distributed Personnel Administration, a comprehensive Data Security System, and on-line and batch report generation. These products are available in multiple technical environments: mainframe systems use standard COBOL with VSAM files or a 4GL (e.g., CSP, NATURAL, IDEAL, IDMS/ADS-OL) with concomitant data base technology (e.g., DB2, ADABAS, DATACOM, IDMS).

Integral Systems products are designed to include a lengthy list of built-in features that are of significant value to the higher education community. The Human Resource Management System is in operation at numerous two-year colleges, local community colleges, four-year colleges and universities, and land grant institutions throughout the United States and Canada. These colleges range in size from 1,000 to 80,000 employees and include the following:

° Boston College
° Harvard
° Rutgers
° Columbia
° Catonsville Community College
° York University (Canada)

Unique higher-education-related features in the Human Resource System include such capabilities as:

° Multiple concurrent appointments (e.g., Asst. Professor and Dean
° "Without salary" appointments
° Management of curriculum vitae information
° Special forms of payment, e.g., stipends, honoraria
° Payment start and stop dates by appointment and account
° Contract and grant certification
° Position control
° FTE tracking and control
° Salary distribution to multiple accounts (e.g., general fund and grants)
° Faculty and staff salary analysis

RECENT ACTIVITY

Integral Systems released three new products this past year:

A DB2 version of the Human Resource Management System, the Pension Benefits Administration System, and the Flexible Compensation System. Integral is the first product applying the standards established by IBM's System Application Architecture (SAA). This product, which uses DB2 (IBM's relational data base manager) was written only with those tools specifically identified as SAA common programming interface products. These products are:

° VS COBOL II
° Structured Query Language (SQL)
° Cross Systems Product (CSP)
° Query Management Facility (QMF)

This exciting product has already been licensed by over fifteen clients, including the University of Illinois.

Many clients have also taken delivery of Integral's new Pension Benefits Administration and Flexible Compensation systems. Both of these products automate the time-consuming tasks of recordkeeping, benefits claculations and projections, and government compliance. Both products have been rapidly accepted as the leaders in the benefits market.

Last year also saw Integral Systems establish a presence in the mid-range marketplace upon its acquisition of SYSGEN. SYSGEN, a developer of financial and human resource software products for the System/38, is headquartered in Research Triangle Park, North Carolina.

Integral Systems, Inc., a CAUSE member since 1979, has participated annually at the CAUSE National Conference since 1974 through vendor presentations and the sponsorship of refreshment breaks at several conferences. It has hosted a conference suite exhibit annually since 1983.

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John Grenzebach & Associates, Inc.

Prospect Profile℠

A Comprehensive Constituent Analysis and Research Tool

What Prospect Profile℠ Can Do For You

A Comprehensive Tool

At the heart of sophisticated and successful fund-raising efforts, from capital campaigns to annual funds, is the need for good prospect identification, evaluation and management. The use of computerized techniques and the latest strategies in marketing research have led the way to powerful new tools for today's fund-raising professionals. Whether it be locating lost alumni addresses, identifying potentially wealthy individuals through geo-demographic screening, segmenting constituent files for donor club or telemarketing solicitations, or even designing the most effective constituent survey questionnaires, PROSPECT PROFILE℠ addresses all of these needs in a comprehensive and cost-effective manner.

Second Generation Methodology

John Grenzebach and Associates, Inc., is recognized for more than twenty-five years of successful consultation in the field of philanthropy. Grenzebach has been an innovative leader in providing computer systems consultation to not-for-profits, and for the early use of geo-demographic screening of prospect lists.

PROSPECT PROFILE℠ now introduces the latest technology in computerized research. It brings about a unique integration of powerful analytical techniques, the most advanced computer software, and the insights of some of the most experienced consultants in the profession today.

PROSPECT PROFILE℠ differs sharply from other electronic screening methods. Relying upon second generation market segmentation technology, it achieves a more discriminating level of prospect identification and analysis, and provides wider access to national data base resources.

We've Gone To the Experts

In seeking to bring its clients the most effective and innovative technology, Grenzebach has formed partnerships with an extraordinary range of corporate resources. These include an array of recognized national experts in survey design, demographic analysis, market research, and consumer data base maintenance.

CLARITAS, L.P., pioneered census-based target marketing in the early seventies and today is an internationally recognized authority in geo-demographic market research. Its PRIZM Cluster System is the oldest and most widely accepted standard employed today by America's primary marketers, media, advertising agencies, research syndicators, and list owners.

METROMAIL CORPORATION maintains what is regarded as the most comprehensive and accurate household/consumer list today, providing large mainframe resources for analysis, and ready access to NCOA, the U.S. Postal Service National Change of Address Service.

Unique agreements have also been developed with several well-known corporate and philanthropic data bases. We have established electronic links to sophisticated resources and we provide cost-advantaged ways to tap them

How Does Prospect Profile℠ Work?

STEP ONE:
Consultation and Study Design

- *Review with one of our Senior Staff Associates the PROSPECT PROFILE℠ Services Manual in the context of your program objectives.*
- *Define your specific PROSPECT PROFILE℠ requirements in regard to capital or annual support needs, or both.*
- *Complete a questionnaire designed to evaluate the current quality and size of your data base, and extract required information for the tasks you've identified.*
- *Prepare your own computer files for accepting new segmentation and demographic data.*
- *Prepare electronic tape media for transferring your data base to our computer systems. Our technical staff will assist in this process.*

STEP TWO:
List Preparation & Enhancement

- *Using Metromail Corporation's resources, we standardize your list by applying the latest requirements of the U.S. Post Office, adding directionals, apartment numbers, full street names and "zip code + 4." This list cleaning process will ensure a higher match when your lists are run against other national data base resources such as TRW and TELEMATCH, providing a greater degree of deliverability for all future mailings.*
- *We then electronically match your prospect lists against the Metromail Consumer data base, which comprises the most recent data on over ninety-five percent of all households in the United States. We can flag the records of those individuals who have moved in the last 18 months, provide new addresses (if desired) or scan your telephone number list, confirming correct numbers and adding new ones.*

STEP THREE:
Geo-Demographic Screening

- *We encode your records using the PRIZM Market Segmentation System. PRIZM "clusters" are built upon the principle that people with similar backgrounds, means, and consumer behavior cluster in neighborhoods suited to their chosen lifestyles. PRIZM clusters represent forty unique neighborhood types, compiled from a statistical analysis of over 1600 fields of socio-economic census data, gathered from every neighborhood in the country. By "geo-coding" home addresses of your constituents, we are able to assign a unique cluster code to each record. Since such "cluster" systems are largely affluence-driven, we can infer relative wealth levels for use in the initial stages of prospect and constituent screening.*
- *To refine the discriminating power of the cluster designations even further, each constituent record is also assigned an "affluence rating," based upon four key factors of affluence: income, education, home values and occupation. The cluster codes and affluence ratings in combination provide useful indicators of philanthropic capacity.*

STEP FOUR:
Demographic Analysis and Constituent Modeling

- *Unique to PROSPECT PROFILE℠ is a secondary level of analysis which examines the relationship of this geo-demographic data to actual demographic variables contained in your constituent records. By analyzing the actual data you provide us on magnetic tape, we develop models for likely philanthropic behavior both for major gift and recurring support programs. The client participates in establishing "modeling" factors unique to that institution. Such factors might include age, degrees earned, alumni status, occupation, and the amount and frequency of giving to the institution.*
- *As an integral part of the "profiling" process, we provide you with the "grid" or "matrix" reports which will be essential to developing program strategies. The results are encoded electronically, and furnished in detailed reports.*

STEP FIVE:
Report Presentation and Consultation

- *Your prospect list will be returned in magnetic tape format with each name profiled and ranked by PRIZM Cluster Codes and affluence ratings. It will also contain the custom screening data developed in our secondary analysis. You can then download the information to your data base to build your own selections and extracts of prospect/donor lists. Address and telephone enhancements are made available in the same manner. This will allow your own staff to build unique strategies for further research, for screening meetings, for targeting cultivation and solicitations, for assigning volunteers, and for developing regional or city sub-lists.*
- *Grenzebach spends a day of consultation with each client reviewing these materials, and providing a number of comprehensive reports and graphics illustrating the quality and characteristics of your data base.*

STEP SIX:
Customized Prospect Research

- *Grenzebach provides links to a number of other national data bases which make available in varying degrees wealth and philanthropic information about prospects and donors. We would be pleased to discuss how these, together with unique and customized survey research tools can turn your fund-raising objectives into useful and effective strategies.*

Campus-wide Networking

Co-ordinating Heterogeneous LAN's

Janet M. Perry
Kinetics
Elizabeth McGee
StarNine Technologies

History of Campus Networks In the seventies, when the use of computers became widespread on campuses, most of the work accomplished was through the use of timesharing and TTY terminals. As microcomputers became more popular, local area networks (LAN's) began to appear. As LAN's became more popular, many companies sold total solutions, i.e. networks that were proprietary and would combine everything together in one networking system. However, as different varieties of computers appeared on campus, these LAN solutions became less complete and often left schools stranded with incompatible and out-dated equipment. Today, network solutions are designed either from the bottom-up or from the top-down. Top-down solutions impose standards campus-wide on cabling, protocols, and topologies. Bottom-up solutions often use proprietary cabling and protocols and are closely related to the microcomputers they work on.

The Power of the Desktop Today where computers are widely used people become devoted to their particular type of computer interface or desktop. Providing interfaces to a number of different computer systems capitalizes on the learning curve and ease-of-use people are accustomed to with their particular computers. Network designers need to take this prejudice into account and provide solutions that let a number of different computers communicate with each other while retaining their own individual interfaces. Ultimately what this means is that as a user you can have access to all databases, all mail systems, and many different applications no matter whether you have a Macintosh, a 386 PC, or a high-end UNIX workstation on your desk. System-wide integration is achieved without any loss of individual choice. This solution doesn't exist yet, but it's on the way. Networking companies, like Kinetics and StarNine, are working to provide these solutions.

Past, Present, and Future all at Once There are many factors that need to be figured into the design and development of heterogeneous LAN's. First, you need to take into account the changing standards in the networking world. Buying from companies that do not plan to migrate to future standards can lead to problems. Second, national and regional networks should be considered as they provide many new possibilities for administrative applications, such as telephone registration, co-operative fund-raising efforts and in high school student recruiting. Third, network planners need to be aware of their own campus needs and look for the solutions that fit in their environment.

Guarding against Obsolescence Whenever a LAN is designed it is important to create one that guards against obsolescence. Long-term as well as short-term goals need to be considered throughout the planning process. By keeping future needs in mind, you can create today a network that will provide flexibility between several different computers while retaining the desktop interface each user prefers. Applications and protocols become integrated as applications become divorced from the underlying protocols. By keeping these factors in mind, you can create network solutions that migrate, today, tomorrow, and in 2001.

Kinetics is a leading developer of networking products for the macintosh, including Macintosh-to-Ethernet connectivity hardware, network application software, and development software. With Kinetics products, the Macintosh user can access systems and services in Macintosh, UNIX, VAX/VMS and DOS environments using a variety of networking protocols. Kinetics network connections support all Macintosh applications, including DBMS, electronic mail, file service, and print service software. Kinetics is located at 2540 Camino Diablo in Walnut Creek California. Their phone is (415) 947-0998.

StarNine Technologies is a UNIX software consulting and development company which provides UNIX-to-Macintosh networking software as well as UNIX interface software. StarNine is located at 2126 Sixth St in Berkeley California. Their phone is (415) 548-0391.

603 Park Point Drive Suite 220
Golden Colorado 80401
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LASERMAX CORPORATION

LaserMax Corporation exhibited two computer systems at the CAUSE '88 conference in Nashville recently. The Company specializes in systems for higher education utilizing the CampusCard™, an optical memory medium in credit card format with a 2.5 megabyte capacity (approximately 1,000 typewritten pages).

On October 17, 1988, the Company installed its first system including software and Read/Write units with personal computers for student identification and transcript applications at the University of Kansas. This test program used approximately 75 students and CampusCards. Initial testing was successfully completed at the University of Kansas in November 1988. A report on the test results will be published sometime in February. The Company intends to install a follow-up test system at this school in the spring of 1989. Negotiations are ongoing with other schools to install cash card, medical card and certain specialty application test systems in 1989.

The CampusCard system consists of an optical memory card, read/write (R/W) device that is attached to a personal computer (or a mini or mainframe), as well as system and application software to perform the needed functions. The company also markets a magnetic cash card system that uses a disposable paperthin magnetic card. Students would purchase these cards and use them in cafeterias, bookstores, vending machines, copy machines and laser printers in lieu of cash. This not only saves the school money but the float on the pre-paid cash can be sufficient to actually pay for the entire system.

The CampusCard system includes optical cards, hardware designed specifically for optical memory cards ("Read/Write Units"), interface and application software. The application software includes identification and security, health services, cash/debit services, registration/fee payment status, and grade transcript storage. Data for all these applications can be stored on a single CampusCard.

The ability of the CampusCard to store significant amounts of data on a portable, wallet-size card creates opportunities to offer new benefits to the college market. By using Read/Write Units and personal computers with a CampusCard system, data can be conveniently read and updated at a variety of locations without having to access a central database or install expensive communication lines to each campus location. Furthermore, the card's portable feature allows privacy of information since the owner controls access to the CampusCard. To make the CampusCard more attractive to colleges who currently use some type of memory storage card, a magnetic stripe and bar codes can be added to the back of the CampusCard so it is compatible with other established systems during an interim period. This will permit the customer to continue using some existing systems while installing a CampusCard system and expanding existing functions.

The CampusCard may function as a student/faculty/staff identification card that includes personal data such as a student identification number, name, address, phone numbers, digitized photographs and digitized signatures. A CampusCard can be used to authorize access into specific areas such as laboratories, dormitories or athletic facilities, depending on the authorization and expiration dates written on the CampusCard by administrative personnel. The

card may also function as a health services card. Appropriate medical information may be encoded on the card allowing health service facilities instant access to medical information. The card can store virtually any type of textual or graphic medical information including a textual medical history, EKGs, x-rays, drug sensitivities and immunization history. All information could be updated as required by campus medical staff or approved local or campus pharmacies. Additionally, software may be designed for the CampusCard so that confidential medical information is not accessible at all campus Read/Write Units.

In addition, the CampusCard may function as a cash/debit card. The student would provide funds to the school and the school would encode information onto the card representing the amount of money the student could spend at school book stores, cafeterias, sporting facilities or selected merchants near campus. By inserting the card into a computer or cash register equipped with a Read/Write Unit and appropriate software and keying his personal identification number, a student could pay for items by having the balance on his CampusCard debited at the point of sale.

Since the reverse side of the CampusCard could carry a magnetic stripe, bar codes or optical character recognition (OCR) characters so as to be compatible with customer's existing systems, the CampusCard may also function as a standard library card using existing library systems with additional information on fees. Students could check out books quickly and accurately as determined by the student's registration and fee payment status encoded on the card. If the cash/debit card function were in use, late charges could immediately be identified and collected from the card.

The CampusCard may also be a portable storage medium for data such as grade transcripts and curriculum information. Transcript information encoded on the CampusCard would be used with appropriate software on campus personal computers to allow a student to plan his curriculum and schedule. This application can save significant faculty advisor time during the curriculum planning and registration process.

An additional technology being evaluated by the Company for use in the campus market is a paper-thin disposable magnetic cash card. Once cash is deposited by parents or students in a school's cash/debit card system, these disposable magnetic cards could be used in place of cash throughout the campus in vending machines, copying machines, cafeterias, bookstores and other locations where small amounts of cash are presently used. Possible advantages to the college include reduced risk of loss, potential increased use of campus facilities, and float obtained by the college by investing the cash that has been deposited.

For additional information, please contact Mr. Bill Eggert, Telephone (303) 526-1229;
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Company Profile

The New Jersey Educational Computer Network, Inc. (NJECN) is a full-service vendor of information products and services. With over fifteen years of experience and a staff of about one hundred individuals, it is associated with higher education in New Jersey. NJECN has a diversified client base, providing services to more than 450 clients in education, state and local government, non-profit organizations, and commercial corporations. Its rates are competitive, and volume and long-term pricing are available.

NJECN serves the higher education community both in New Jersey and the surrounding areas.

Involvement in Higher Education

NJECN provides a wide variety of computing services for instruction, research, and administration to all of the New Jersey State Colleges, the New Jersey Institute of Technology, University of Medicine and Dentistry of New Jersey, and to many independent, county, and junior colleges. Its services are available through a state-of-the-art wide area network.

■ *Instruction*. Its central computing facility offers a supplement to local computing facilities, with a wide variety of IBM mainframe compilers in the MVS, VM/CMS, and MUSIC operating environments. Faculty use NJECN to teach data base courses, data analysis using SAS or SPSSx, and programming languages such as COBOL.

■ *Research*.When high speed, heavy duty computing is needed, NJECN assists researchers. SAS, SPSSx, IMSL, and other resources are available to aid in the analysis of data. Machine readable data are available which allows researchers to engage in secondary analysis, thus building on the work of others.

■ *Administration*. Historically, NJECN has provided New Jersey institutions of higher education with a wide range of services, from running production applications on a regular basis (i.e., accounting, payroll) to providing contract programming and various technical services. NJECN also provides facilities management services for several institutions by managing the daily operations of their data centers.

■ *Network Affiliations*. NJECN belongs to several organizations and networks which benefit educational institutions, including CAUSE, EDUCOM, BITNET, EDUNET, and CONDUIT.

Products and Services

NJECN provides a wide variety of information products and services including:

■ *Technical Support and Management Services*. NJECN has reduced the management problems and concerns associated with providing high quality and reliable information processing by:

- Operating equipment at client facilities or at NJECN's location.
- Providing data communications support services which insure maximum availability with the best possible response time.
- Providing technical staff to support a full range of technical services and systems programming.
- Installing any hardware or software a client has acquired.
- Providing procedures/facilities for backup and off-site storage.
- Providing operational procedures for the production environment to ensure that critical jobs are run on time.
- Recruiting, hiring, training, and retaining key personnel.

■ *Communications Services*. Perhaps the key ingredient for success in today's environment is in the area of communications. NJECN has assisted in planning and implementing environments that meet the immediate and future needs of clients. The company has expertise in all areas of communications, including voice, data, video, graphics, image, security, and energy management. Its experience includes:

- Design and installation of local and wide area networks.
- Needs analysis and planning.
- Design and installation of an SNA network consisting of over 400 terminals, personal computers, printing, and graphic displays.
- Design, installation, and maintenance of a domestic and international network which involved working with several communications carriers and required expertise in X.25, SNA, bisync, async, and batch protocols.
- Design, installation, and maintenance of a fiber-optic-based network.

■ *Consulting and Planning*. NJECN provides high quality consulting and planning services in the areas of communications, systems, and management issues.

- Operations Audits
- Capacity Planning
- Data Center Security
- RFP Preparation/Bid Analysis
- Local/Wide Area Networks
- Microcomputer Consulting

■ *Disaster Recovery*. NJECN will plan and act as a disaster recovery site for a client's data processing systems. Its services include consulting for disaster recovery planning, formal documentation, implementation planning, and testing. All of these ensure that there is a hardware/software system readily prepared and accessible in the event a client's system is rendered unusable due to a disaster.

■ *Logical Machine Services*. NJECN will provide to clients a fixed amount of processing resources equivalent to that of a specific IBM mainframe or part thereof (i.e., an IBM 4341, an IBM 4381, etc.). This service provides the equivalent power and capacity but at a much lower cost than if the client purchased the system on its own.

■ *Software and Machine Services*. NJECN owns two IBM mainframes which are available on a 24-hour, 7-day-a-week basis. In addition, its teleprocessing network is serviced by several front-end processors and includes state-of-the-art monitoring, dial backup, and diagnostic systems to ensure high quality transmission, system reliability, and user satisfaction.

NJECN offers a wide variety of interactive and batch software compilers for the most commonly-used programming languages; state-of-the-art file editors; fourth generation languages; data base products; and statistical/mathematical products.

■ *Custom Software Development*. NJECN has the technical and managerial staff required to provide applications development services in all phases of the project development life cycle. The company works closely with its clients to analyze their needs and develop systems which meet immediate and future requirements. NJECN assumes complete project accountability, and follows established project management techniques to ensure a quality system, delivered on time and within budget.

CAUSE welcomes NJECN as a new Corporate Member.

Contact:

Sales and Marketing Department
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Edison, NJ 08820
(201) 549-9700

NOVELL

122 East 1700 South
Provo, Utah
(800)453-1267

Overview

In 1980 Novell, Inc., began as Novell Data Systems Inc. in Provo, Utah, developing computer products for the CP/M operating system. By the time IBM introduced its Personal Computer in 1982, Novell had begun to develop a network operating system that could connect a number of operating systems, including CP/M, PC-DOS and UNIX. This network later developed into NetWare, today's standard local area network (LAN) operating system.

In early 1983, Novell introduced a file server that brought greater functionality and connectivity to LANs. Novell moved control of access to LAN's file systems from each workstation to a central operating system. Novell's market-driven philosophy, coupled with NetWare's open architecture and high performance, provided Novell customers with the flexibility they needed.

Novell was incorporated in January 1983 and went public in February of 1985. In 1988 Novell became a quarter billion dollar company. Today Novell's market includes small to large businesses, government agencies, higher education institutions, and workgroups and departments within corporations.

Novell offers a wide range of connectivity products including NetWare for Macintosh, NetWare for VMS, NetWare for DOS and NetWare for OS/2. More than 300,000 copies of NetWare are installed worldwide, connecting over two million workstations. The company currently ships about 10,000 copies of NetWare per month.

In addition, Novell's Communications Products Division offers products that allow local area networks to be connected to larger departmental systems and wide area networks including LAN bridges, PC-to-host gateways and connections between electronic mail systems.

Special Interests in Higher Education

Novell offers its full support to colleges and universities striving for new heights in technical expertise:

* *Enhancements to keep networking systems state of the art*
* *Training to encourage academic and institutional advancement*
* *Contracts allowing institutions to upgrade economically as needed*

Novell's Campus Support Centers provide technical expertise quickly to colleges and universities currently using Novell products by training a designated employee or department. Novell conducts the training to ensure an employee from each center will graduate with the same qualifications as Novell's own resellers. With this training, campus employees can immediately resolve technical support questions, serve as a liaison with Novell technical support personnel, and maintain contact with counterparts at other educational institutions.

Novell's awards starter grants for NetWare operating systems to higher education institutions. Through these programs Novell supports its commitment to higher education by encouraging the use of networking and distribution processing technology.

Products

NetWare for Macintosh

NetWare for Macintosh is a software package that gives Macintosh workstations full access to the services of NetWare v2.15 network servers (SFT, Advanced or ELS NetWare Level II). It brings enhanced security, resource accounting and system reliability to Macintosh users.

Featuring 100 percent AppleTalk compatibility, NetWare for Macintosh transforms economical IBM-compatible PCs into high-performance AppleShare network servers. It allows transparent file, message and printer sharing among Macintoshes and PCs.

Designed specifically for the Apple Macintosh, NetWare for Macintosh requires an 80286 or 80386 network server running NetWare v2.15 or higher. It accommodates both the LocalTalk and EtherTalk Macintosh cabling schemes.

NetWare for VMS

NetWare for VMS is a software product that allows any VAX computer (under VMS) to function as a network server for IBM and IBM-compatible PC's. Operating as a single process within the VAX, NetWare for VMS lets PC users share access to data, print services and applications from any location on the network.

SFT NetWare v2.15

SFT NetWare delivers the full functionality of the NetWare LAN operating system, while providing the high-level security, system reliability and accounting features required by major corporations and public institutions. SFT NetWare v2.15 provides network services to both PC and Macintosh workstations.

SFT NetWare provides insurance against downtime. It dramatically reduces the impact of network equipment failure with its duplicate directory structures, disk mirroring and disk duplexing capabilities. In addition, the Transaction Tracking System (TTS) protects information from being corrupted or destroyed if a failure occurs during a database update. An uninterruptible power supply (UPS) monitoring function ensures data is not lost during power fluctuations and outages.

The security features of SFT NetWare make it possible for system supervisors to prevent unauthorized access to sensitive data. A user's access can be limited to designated files, to a specified workstation and to certain hours of the day. Passwords are encrypted, and the supervisor can specify they be changed periodically and be a minimum length. Login attempts can also be limited.

System accounting features in SFT NetWare allow schools to charge for network resource use. Users can be charged for connection time, for use of storage space on disks or for the number of requests made by a workstation. Rates can vary by the hour or by the day. Supervisors can assign credit limits, monitor user account balances and logout users if they overextend their credit limits.

ORACLE FOCUSES ON HIGHER EDUCATION

Recognizing that the computing needs of colleges and universities differ considerably from those of our corporate accounts, ORACLE CORPORATION is pleased to announce the formation of its Higher Education Division. This group seeks to understand and satisfy the special academic and administrative needs of educational institutions around the country.

CAUSE88

One of the first goals of ORACLE's Higher Education Division was to participate in CAUSE88. ORACLE would like to thank the hundreds of convention attendees that dropped by our booth. We enjoyed meeting with you and appreciated the opportunity to discuss our program, demonstrate ORACLE products, and illustrate some of the ways universities are using our Relational Database Management System. We were very pleased with the enthusiastic response to our new Higher Education Division and to ORACLE products.

continued . . .

Oracle was also presented in the SCT booth and the Apple Computer booth. SCT's flagship BANNER™ series is an administrative system based on ORACLE's RDBMS. In the Apple booth, staff members of the University of Tennessee/Memphis demonstrated ORACLE's new Macintosh products in a variety of administrative applications.

We would like to give special thanks to UT/Memphis for the presentation they gave at the convention. They delivered an excellent talk, highlighting over 50 systems they have developed using ORACLE's RDBMS and demonstrating their Student Information System, Parking System and Animal Resources System.

CAUSE88 was a great success for ORACLE. We look forward to working with colleges and universities, helping them meet their growing computing needs and future goals.

Peat Marwick Main & Co.
Nolan, Norton & Co.
(An Information Technology Firm of Peat Marwick)

CAUSE88 Vendor Presentation
November 30, 1988

R. Schuyler Lesher, Jr.
Allan F. Froehlich

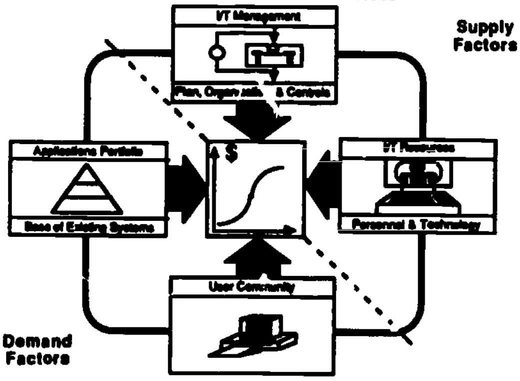
NNC's Baseline, or Stage, Assessment

The Information Technology (I/T) management activity may be viewed and managed as a business. The fundamental charter which defines the role of this "business" is to support the overall organization of which it is a part. Since its products and services are integral to current operations and will become increasingly vital as the organization evolves, effective linkage of business and systems strategies is required to ensure long-term viability. This is particularly true of institutions of higher education which must successfully tap the computer as a competitive resource.

Peat Marwick Main & Co.'s approach to assessing a firm's I/T environment, using Nolan, Norton & Co.'s (NNC) methodologies, is called The Baseline, or Stage, Assessment. It is based on a framework to make the business-to-I/T linkage possible and has been successfully used in NNC's consulting assignments from the late 1970s. The framework derives from Richard L. Nolan's groundbreaking work on the use of I/T by organizations*. The framework provides us with a tool for segregating the issues and evaluating the relationships among the various "growth processes" (Figure 1) that drive organizational change. Those growth processes, along with a financial analysis, form the core of the baseline assessment.

Figure 1

The Four Growth Processes



The Baseline Assessment examines the state of I/T and the business processing environment. It is the foundation upon which the I/T strategy and plan are built. Analyzing the four growth processes provides insight into how I/T is and can ba applied to business goals. The role of each is described below.

The **Application Portfolio** growth process is used to evaluate the current level of I/T support to the business. This is accomplished by building a functional model of each line of business, using Robert Anthony's approach to organization management developed at the Harvard Business School in the early 1960s.

The portfolio is designed to represent the functions performed by the client organization at the operational, management control, and strategic planning level. The penetration or coverage of systems in each functional area is measured by collecting specific information from user managers and conducting comparative analyses. This concept of system coverage and quality can assist in focusing future I/T investments and can also be utilized to monitor the future progress of system implementation.

*"Managing the Four Stages of EDP Growth," C.F. Gibson and R.L. Nolan, Harvard Business Review, Jan.-Feb. 1974, vol. 52., no. 1.

The **User Community** growth process is used to determine how able users are to take advantage of the manner in which I/T resources are utilized. An absolute pre-condition for change in an organization is the ability of users to assimilate that change and define their systems needs.

The **I/T Management** and **I/T Resources** growth processes provide the primary basis for evaluating the placement, delivery capabilities, and decision-making process within the I/T organization. The management approach process addresses the appropriate organizational structures and placement of I/T relative to how the institution is structured and what the institution is trying to achieve. It also addresses the management programs required to assist I/T and management in utilizing I/T to its maximum leverage in achieving organizational objectives. The resources process focuses on the human and technology resources required to develop and operate systems effectively.

Finally, the **Financial Analysis** assists client organizations in understanding their I/T investment. This analysis focuses on determining the appropriate I/T funding levels and allocations through utilization of the NNC Chart of Accounts for I/T. As NNC has consistently applied its chart of accounts in over 500 organizations, and has built a substantial database of benchmarks, it can conduct a very powerful analysis of the I/T expenditures.

The chart in Figure 2 shows the changes organizations must assimilate in each growth process as they move through the different stages of growth.

Figure 2

Management of the Growth Processes

Growth Process	Stage I Initiation	Stage II Contagion	Stage III Control	Stage IV Integration	Stage V Data Admin.	Stage VI Maturity
Applications Portfolio	Functional Cost Reduction Applications	Proliferation	Upgrade Documentation and Restructuring of Applications	Retrofitting Existing Applications Using Data Base Technology	Organizational Integration of Applications	Application Integration "Mirroring" Information Flows
I/T Resources	Technologists	User-oriented Programmers	Middle Management	User Account Teams	Data Administration	Data Resource Management
Technology	Batch		Computer Utility	Database and On-Line	Distributed Network	Office Automation
I/T Organization	Centralization	Centralization/ Decentralization	Centralization	Cent./Decent.	Decentralization	Centralization/ Decentralization
Planning and Control	Lax	More Lax	Formalized Planning and Control	Tailored Planning and Control Systems	Shared Data and Common Systems	Data Resource Strategic Planning
User Awareness	"Hands Off"	Superficially Enthusiastic	Arbitrarily Held Accountable	Accountability Learning	Effectively Accountable	Acceptance of Joint User and Data Processing Accountability

DP Expenditures

Information Technology (I/T) today requires all organizations to take a new look at institutional structures. Higher Education, as other industries, needs to understand that to realize the benefits of information technology, organizational structures, communication methods, and management processes will change. To do this, individuals addressing I/T directions will need new frameworks to focus on the education, research and institutional environment I/T needs of our higher educational institutions. The methodologies described provide a very powerful framework for assessing an organization's I/T position and can provide the foundation for moving forward as part of an I/T strategic planning process.

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Prime.

Company Profile

Prime Computer, a Fortune 500 multi-national computer company, was founded in 1972 and is based in Natick, Massachusetts. Prime was the first computer company to market a 32-bit, virtual memory superminicomputer. Prime now manufactures, markets, and supports, on a worldwide basis, a compatible line of high-quality, integrated, general purpose computer systems for education, science and engineering, commercially distributed data processing, and CAD/CAM.

Prime employs over 11,000 people, has over 18,000 computer systems in use worldwide, and offers over 2,500 third-party application packages.

Involvement in Higher Education

The education sector is the third-largest industry representation among Prime users: over 1,000 colleges and universities operate Prime equipment worldwide. Prime's Educational Grant Allowance Program (EGAP) offers substantial grant allowances for systems utilized in academic and research computing. Prime also offers special programs for education.

Products and Services

UNIX ENVIRONMENT

• *Prime EXL™ Series* is based on AT&T's UNIX System V.3 and Intel's 80386 processor. The PRIME EXL Series offers a 3.2-5 MIPS performance range, with up to 114 direct connect terminals. The series offers transparent access between DOS and UNIX operating systems as well as easy data exchange facilities between DOS and UNIX applications.

• *PXCL™ 5500* is a single user, 3D color graphics workstation. Running the UNIX system V.3 operating system, its custom VLSI floating point graphics processors provide 137,000 32-bit, 3D floating point coordinate transformations per second.

• *MXCL 5™* is a departmental supercomputer for engineering, scientific, and numerically intensive applications. It is an integrated set of high-performance 32-bit Interactive Processors (IPs). The MXCL 5 system architecture employs widely-used software and hardware standards: UNIX V.3, FORTRAN 77, VME, Ethernet, and TCP/IP.

50 SERIES OFFICE SYSTEMS

• *2350™* and *2450™* Fully compatible with all 50 Series superminis, they serve up to 32 users, up to 8 million characters of memory, and up to 516 million characters of disk storage. They execute at up to 1.3 MIPS yet require only one-quarter the floor space of the Prime 2755 system.

• *2455™* ideal for distributed processing network nodes or compact, multi-user system applications, the system has 64Kb cache memory, up to 774MB disk storage, and supports up to 40 directly connected terminals.

• *4050™* and *4150™* are office-installable minicomputers capable of executing up to 4.1 MIPS. They will support up to 255 simultaneous active processes, with 32 MB of memory and four 770 MB disks in an office environment.

50 SERIES COMPUTER ROOM SYSTEMS

• *9955 II™* This system executes up to 5.8 MIPS, has 64Kb cache memory and up to 32MB MOS memory, and supports up to 254 interactive terminals and 255 simultaneous processes, ECL circuitry, burst-mode I/O, and five-stage synchronous pipeline architecture.

• *6350™* and *6550™* Prime's top-of-the-line superminicomputers, ideal for computational, administrative, or CAD/CAM/CAE applications in stand-alone or net-

worked environments. The 6550 executes up to 23.6 MIPS. Very large scale integration (VLSI) emitter-coupled logic (ECL) components allow the 6550 to achieve a level of performance traditionally found in mainframes.

SOFTWARE PRODUCTS
Examples of software products include:

- *PRIMOS®* The proprietary operating system common to all 50 Series computers.
- *UNIX®* An operating system based on AT&T's UNIX System V.3.
- *LAN300* Featuring industry-standard IEEE 802.3/Ethernet compatibility, it provides the hardware and software for 50 Series systems, workstations, and systems from other vendors to interconnect and interoperate using TCP/IP-based protocols.
- *PrimeINFORMATION™* A relational-like data management system, optimized for rapid and flexible end-user application development.
- *Prime ORACLE* An enhanced version of an SQL-based relational data base management product. Provides a foundation for new systems development and a user-friendly environment for software programming, decision support, business and systems analysis.

APPLICATION PACKAGES
More than 2,500 software applications run on Prime superminicomputers, offering those in the academic world access to the varied and often unique software they need.

The quality of the administrative packages available through Prime's third-party partners has led education customers worldwide to use Prime systems for administrative functions. Comprehensive packages are available to track students all the way from initial inquiry to alumni status. These packages also provide state-of-the-art solutions for registration and grading, billing, accounting, payroll, human resources, fund raising, and the other complex operations of a college or university.

The word processing and electronic mail capabilities of Prime's Office Automation System allow faculty, administrators, and staff to write and process documents and communicate efficiently. Other packages are dedicated to specific needs such as health center management, library automation, and facilities maintenance.

Popular statistical analysis packages that were once limited to mainframes now run on Prime superminicomputers. Students put theories into practice with powerful simulation software. With over 100 third-party CAD/CAE packages, Prime systems are allowing engineering colleges and technical schools to integrate computer-aided design and computer-aided engineering into their curricula.

Computer-aided instruction (CAI) authoring languages allow faculty with no computer background to develop their own computer-aided teaching materials software.

Prime Computer joined CAUSE in 1986, and has hosted suite exhibits at the last two CAUSE National Conferences.

Contact:

Richard Johnson
Manager, Marketing Programs
Education Industry Marketing
Prime Computer, Inc.
Prime Park
Natick, Massachusetts 01760
(617) 655-8000 Ext. 7093

INGRES
RELATIONAL TECHNOLOGY

CAUSE88 Report

INGRES and IA Become Partners!

An agreement signed in October enables Information Associates to market and distribute *INGRES*, Relational Technology's advanced distributed data management and application development environment.

Today IA is expanding the use of 4GLs and adapting its current product line to run on relational databases. Current plans also include development with an *INGRES* toolset.

University of Chicago Highlights NEW Application.

The Graduate School of Business at the University of Chicago has developed a comprehensive, integrated administrative package built entirely with *INGRES*. Modules include: Admissions, Financial Aid, Placement, Academic Services, Registration, Alumni Development, and Academic Services. Information can be obtained from Terry Merkley at (312) 702-7411 at the GSB.

Educational Grant Program Still Available.

The Educational Grant Program allows you to use all *INGRES* software on your campus a small fraction of the usual cost. The program is designed to encourage integration of administrative, research and teaching activities. Call your RTI or IA representatives

for details. Here is a current listing of the Educational Grant Recipients:

MIT
University of California, Berkeley
Carnegie Mellon University
University of Colorado
University of North Carolina
University of Chicago
Indiana University
University of Wisconsin
Athabasca University
Research Triangle Institute
Massachusetts Public Higher Education (29 Campuses)
Maricopa Community Colleges
San Diego State University

Using *INGRES* Means:

- Quick and easy reports and queries.
- Faster application development.
- Connectivity across campus.

Portability among hardware environments and operating systems.

Relational Technology, Inc., provides *INGRES*, the largest selling relational database management system in higher education.

Relational Technology
1080 Marina Village Parkway
Alameda, California 94501
1-(800) 4- *INGRES*

Partners

We were pleased to be a first-time vendor at the CAUSE88 conference. It was a great way to introduce ourselves and meet new friends. It was also an excellent way to showcase a revolutionary product — our 4400 Automated Cartridge System (ACS).

This fully automated, cartridge-based information storage and retrieval product fills the void between existing online and offline systems by creating a revolutionary Nearline™ system. Unique to the 4400 ACS, nearline stores data at a fraction of the cost per megabyte of online storage. But its quick, consistent response time places it much closer to DASD in performance.

The 4400 ACS automatically mounts and demounts 18-track cartridges on the StorageTek 4480 — a cartridge subsystem that is completely compatible with the IBM 3480 manual-only subsystem. The advanced robotics retrieves and delivers cartridges in an average time of 11 seconds. And with a footprint 30 percent to 70 percent smaller than that of comparable manual systems, the 4400 ACS stores data at less than $.50 per megabyte purchased.

The 4400 ACS is just one example of StorageTek's innovative style and customer responsiveness. Founded in 1969, we design, manufacture, market, provide supporting software and service four basic product lines — solid-state disk, disk, tape and printers. Approximately 8,800 people are working hard for you at our Colorado-based headquarters and at more than 130 sales and service locations worldwide.

At StorageTek, we believe in partnerships. Jacque Byrne, our public sector marketing representative, can tell you how a partnership with StorageTek can make a difference in your data center. Call her today at (303) 673-6550.

StorageTek.

Storage Technology Corporation · 2270 South 88th Street · Louisville Colorado 80028 4338

sun
microsystems

Sun Microsystems marked its entry into the adminstrative computing market at CAUSE 88 with the announcement of an agreement with Information Associates to port the Series Z product to Sun–3 workstations.

Sun and IA held demonstrations of the new product in the IA suite, and sponsored one of the CAUSE beverage breaks. Aimed at the UNIX market, the Sun/IA solution will be an affordable, expandable system supporting distributed databases and data processing across a networked computing environment. Sun's interconnectivity products, such as its TOPS network software and the Sun IPC PC emulation board, allow users to inexpensively access existing DOS and Macintosh software. Sun will be the first UNIX vendor to support IA's products.

The early adopters of Sun workstations were universities and research laboratories. Today, Sun workstations are installed in major universities in such diverse disciplines as architecture, geology, philosophy, computer science, biology, engineering, law, anthropology, and economics. In addition to traditional uses in research, Sun systems are being selected as the workstation of choice in new areas such as instructional laboratories and library automation. This new administrative computing solution will round out the Sun campus offering and allow Sun to further serve the higher education market.

SCT ACTIVITIES AT CAUSE88

It was a BANNER year for Systems & Computer Technology Corp. (SCT) at CAUSE88.

Using colorful streamers draped from a central "tower", SCT's display in the Corporate Demonstration Area featured both its BANNER™ and SYMMETRY™ administrative applications for higher education.

Building upon the CAUSE87 announcement of the BANNER Student System, SCT unveiled the two newest systems in the BANNER Series -- Alumni/Donor Development and Finance. SCT reinforced its commitment to relational database technology with the introduction of these additional products -- which unite the ORACLE® 4GL relational DBMS with distributed processing and rule-based architecture. The many visitors to the SCT display could also see live demonstrations of BANNER Student and Alumni.

Another section of the booth highlighted SCT's SYMMETRY™ Series, based on the SUPRA™ relational DBMS. These applications for larger IBM mainframe users provide high-powered functionality for Student, Finance, Human Resources and Alumni/Development requirements.

High quality, technically current software -- coupled with specialists in education and technology trends -- are critical components in the successful planning and implementation efforts of higher education. SCT's experienced people, SYMMETRY and BANNER software and 20 years of specialized service to higher education -- have allowed us the opportunity to act as a cornerstone -- in a large number of these successful efforts.

Speaking on behalf of such success stories in SCT's vendor track, were two of the BANNER Series early-support clients -- The West Virginia Network for Educational Telecomputing (WVNET) and Worcester Polytechnic Institute (WPI). Henry Blosser, Associate Director-User Support for WVNET, and Patricia Flaherty, Project Manager-Information Systems for WPI, discussed how they evaluated and selected new student systems -- and reviewed their recent successful implementations of the BANNER Student System.

SCT's commitment to technical currency was demonstrated by the Company's announcement during the conference of a joint marketing agreement with Sequent Computer Systems, Inc., to offer the BANNER Series software on Sequent's Symmetry™ Computer Systems. Sequent, headquartered in Beaverton, Ore., is a leading supplier of high-performance, parallel-computing UNIX systems. In addition to Sequent, BANNER is available for IBM, Digital, Data General and Hewlett-Packard hardware environments.

For the seventh consecutive year, SCT proudly sponsored the CAUSE/Effect "Contributor of the Year" award. The 1988 winners were Robert R. Blackmun, Director of Computing Services - University of North Carolina/Charlotte, Jeff N. Hunter, Manager of Information Resources & Contract Services - North Carolina State University, and Anne S. Parker, Director- Microcomputing Support Center at the University of North Carolina/Chapel Hill, for their article "Organizational Strategies for End-User Computing Support".

USC SOFTWARE SYSTEMS

The University of Southern California (USC) is one of the country's major private educational and research institutions. Many people know it for its many illustrious graduates, others remember it as a proud host of the successful 1984 Summer Olympics.

USC now has yet another claim to fame: It is a pioneer in computer system development. Under the pressure of very tight deadlines, USC's development teams have created online, fully-integrated administrative systems that are without equal. The systems components are wide-ranging, and include such modules as accounts payable, purchasing general ledger, budget management, personnel/payroll, fundraising, and student support services.

As we demonstrated our systems to administrators from around the world, we were constantly encouraged to offer it in the marketplace so that others could take advantage of our research and development. As a result, USC is now marketing this software. We are very proud of our systems and believe that they can enhance administrative processing for other educational institutions and non-profit organizations.

While the systems function as an integrated whole, each of its components can be purchased separately.

Should You Purchase USC Software Systems?

If your data processing requests are backlogged;
If it takes days to provide a straightforward report from your database;
If you need to be a programmer to generate reports;
If your data processing staff turns surly when you mention making changes to existing systems.

You should consider USC Software Systems, for we found a better way. Give us the opportunity to show you how managing your organization's data processing needs can be transformed from a nightmare into a joy.

A Brief History

The earlier USC administrative systems ran on IBM machines using standard IBM tools such as IMS databases, COBOL programs, etc., which proved to be inadequate. Lead time for development took years, and a large maintenance backlog was the status quo. It was clear that a totally new direction in computing would be needed. In a somewhat unprecedented "leap of faith", the university decided to develop its own family of administrative information systems using minicomputers and in-house software. We have never looked back.

Money Matters: The Financial Accounting System

The core of USC's financial system is its **General Ledger**. The General Ledger module maintains the chart of accounts, tracks journal entries, and performs system balancing. Balancing is done daily and can be monitored online by the Accounting Office.

The **Purchasing** is a vendor-based system that allows agents to enter purchase orders directly online and accounts are encumbered through a link to the General Ledger module. The system prints purchase orders, and provides for change orders, cancellations, order reopening, and a variety of inquiry functions. The system can generate reports that show bid and volume statistics by buyer.

The **Accounts Payable** module includes invoice entry, purchase order inquiry, vendor profile creation, payment scheduling, check printing, and payment and check status inquiry.

The **Cash receipts** are entered online with automatic verification of account numbers. Multiple "payment modes" are provided, and are used to automatically accumulate the debit side of transactions for posting to the General Ledger. The modes are user-defined and can be altered at any time without requiring a programmer.

The **Budget Administration System** enables every department of the University to examine its budget by account and category of expense or revenue, and permits controlled access to a wide variety of operational information.

The **Human Resources System** performs payroll/personnel functions. All deductions, reductions, tax data, and year-to-date information is printed on check stubs. Changes of name, insurance beneficiary, etc., are centrally controlled, and employees can see the same information that is available to the payroll department.

Alumni Relations: Fun and Fundraising

The **University Relations System** helps the University maintain good relationships with its alumni through special Events scheduling, and provides the information management features needed to gather funds and predict future giving trends. Tracking of monies given for specific purposes is also included.

Supporting the Business of Education: Student Information System

The **Student Information System** is the most comprehensive online student system in the country. The host of its components include:

The **Admissions** component supports recruitment efforts, inquiry response processing, application processing, admission decision making, and credit evaluation and articulation. Automatic decision recommendation quickly identifies highly-qualified applicants. The system contains a personalized letter writer which can combine pre-storedparagraphs, permit customized additions, and insert name, school and other variables into a form letter.

The **Financial Aid** component supports the entire financial aid process from the early tracking of documents and required information, to the final application of aid to the student's financial account. The system perfoms online needs analysis, online packaging, online repackaging resulting from registration change, tracking of items required to complete application and automated "lack" notices.

The **Registration and Records** component supports several important functions, including: the on-line course catalog; the program of study table (POST); class room scheduling; registration; grade processing; transcript management; degree check; academic status, and much more.

The **Bursar Operations** support several key financial operations: the Consolidated Receivables System provides a centralized and consolidated billing system for student financial accounts; the Collection Mangement System tracks a student's account and alerts collections staff of dilinquent payments, bad checks, late payments, etc.; the Agency Billing System supports payments of student charges by third parties such as governtments, corporations and other outside agencies.

Technical Details

USC's administrative systems run on PRIME computers using the INFORMATION operating system. With the use of a development shortcut tool called **TOADS**©, also created by USC, programmers are now able to deliver systems or changes to systems in months rather than years. It is because of the flexibility of the INFORMATION environment, and the speed of development offered by TOADS, that USC has been able to develop such a comprehensive system in so little time, and continue to keep it current with changing needs.

Lessons Learned

Implementation of the University's Administrative Information Systems has been very successful, as measured by user acceptance. More than 2000 administrators and faculty have system authorization, and more than 500 access it daily. With USC's integrated system, employees spend less time recording, calculating and organizing data, and more time projecting and analyzing what it means. Replacing labor-intensive processes with systems tailored to each application has moved USC toward paperless "input-it-once" processing, and the cost savings have more than paid for development costs. One department alone reassigned 36 positions after implementation, better using human resources and saving over $800,000 in annual compensation.

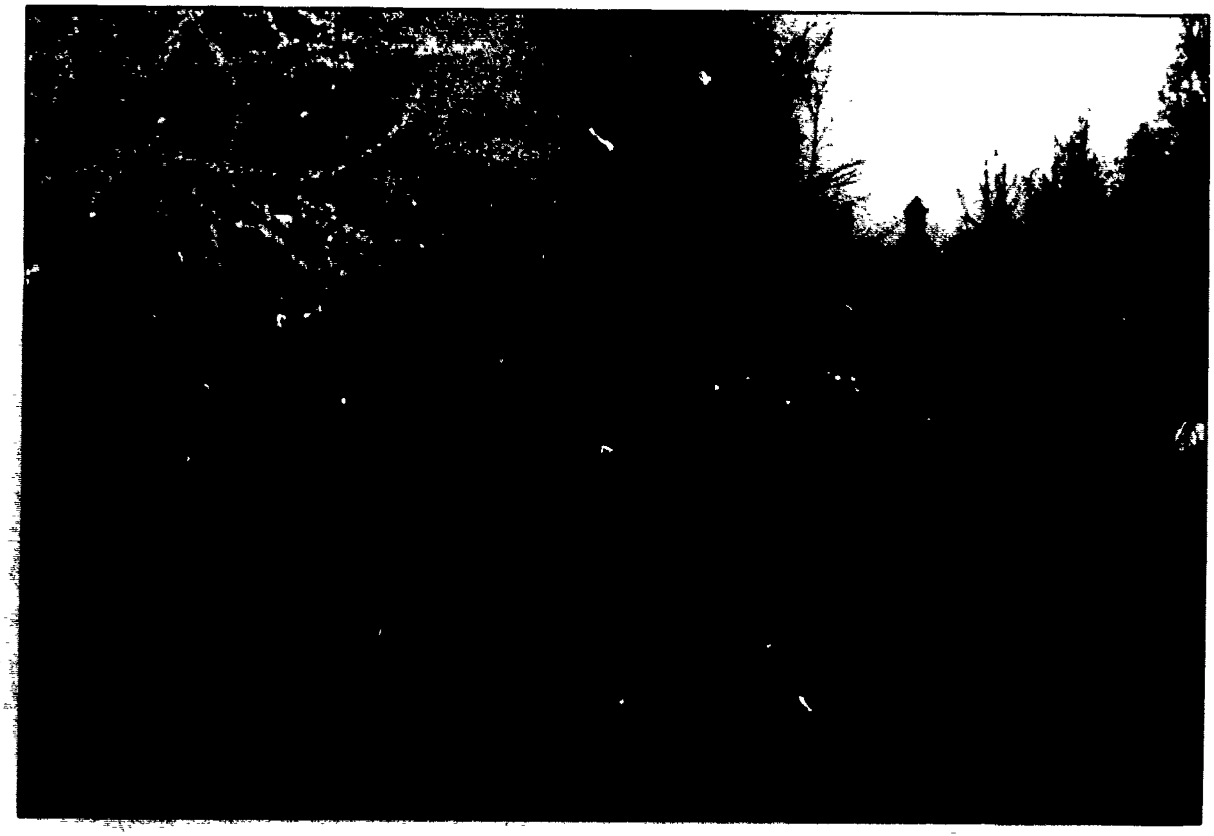
©Total Online Application Development System, Copyright 1986 University of Southern California

Pictorial Highlights of CAUSE88

From the opening reception aboard the General Jackson riverboat on the Cumberland River, sponsored by Digital, to a closing Current Issues Forum that drew enthusiastic discussion and compliments, CAUSE88 was one of the finest in the history of CAUSE national conferences.

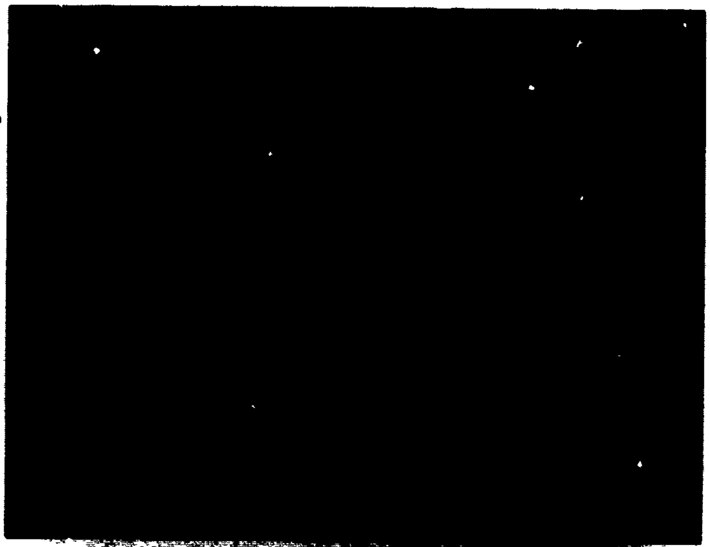
Evaluations turned in by conference participants consistently praise this conference—with special recognition of the valuable opportunities to share experiences with colleagues. They indicate that the "leisure" time—receptions, meals, refreshment breaks—can be almost as valuable for learning and making useful contacts as the many formal presentations and less-formal sessions that fill the conference program. Pictures on the following pages reflect the extent to which conferees took advantage of these opportunities.

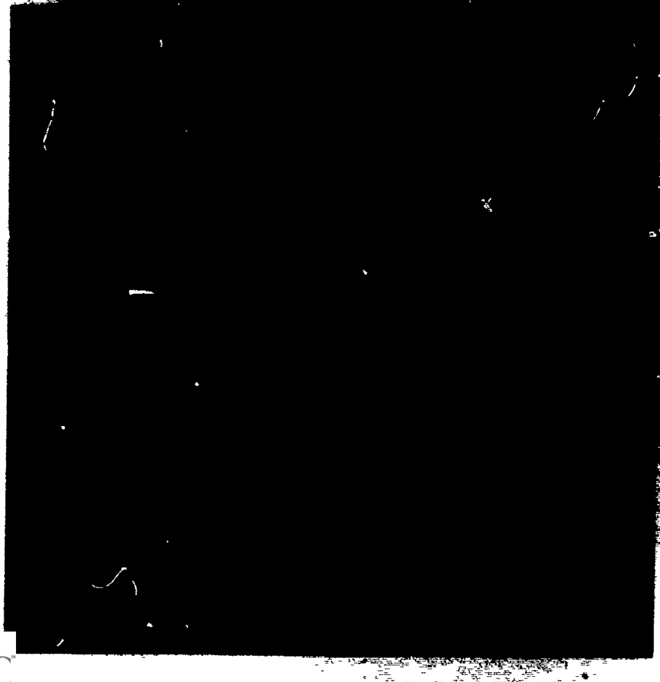
The high level of participation by both higher education professionals and corporations, the new conference messaging system developed by Apple Computer and HyperPro, the new daily conference newsletter sponsored by Apple and Kinko's Academic Software Exchange, the colorful and action-packed *Country Christmas Musical Revue* sponsored by IBM on Thursday night, enchanting holiday decorations throughout the vast Opryland Hotel—all were very special features of this year's conference.



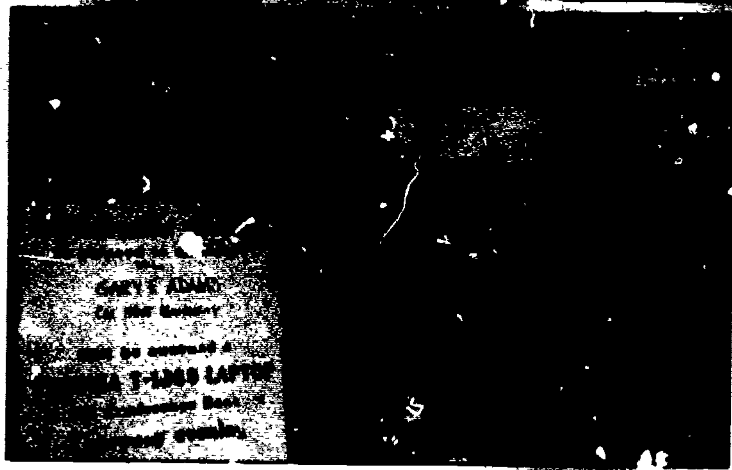
Corporate Exhibits

For the first time this year, the CAUSE National Conference offered an exhibition hall in addition to individual vendor suite exhibits for the display of vendor products and services. The Corporate Demo Area also housed the CAUSE88 Hospitality Park in which refreshments were served continuously. With 25 corporations exhibiting in the Corporate Demo Area and 14 offering special exhibits and hospitality in individual suites, conferees enjoyed easy access to information about the newest in information technology resources for higher education.



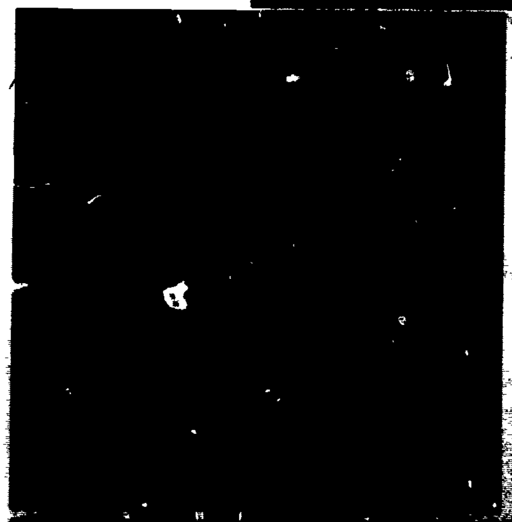


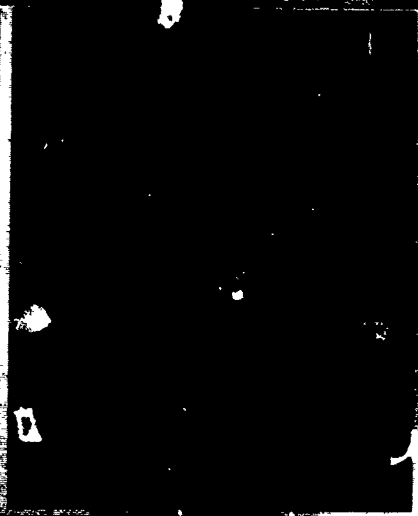
Corporate Exhibits

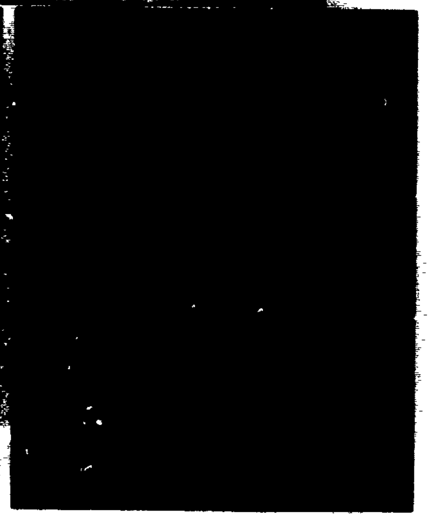


Continuous refreshments were offered in the CAUSE88 Hospitality Park, set in the midst of the bustle of the Corporate Demo Area. Refreshments were sponsored by EDUTECH International, George Kaludis Associates, Inc., the New Jersey Educational Computer Network, Inc., Peat Marwick Main & Co., and Sun Microsystems, Inc.

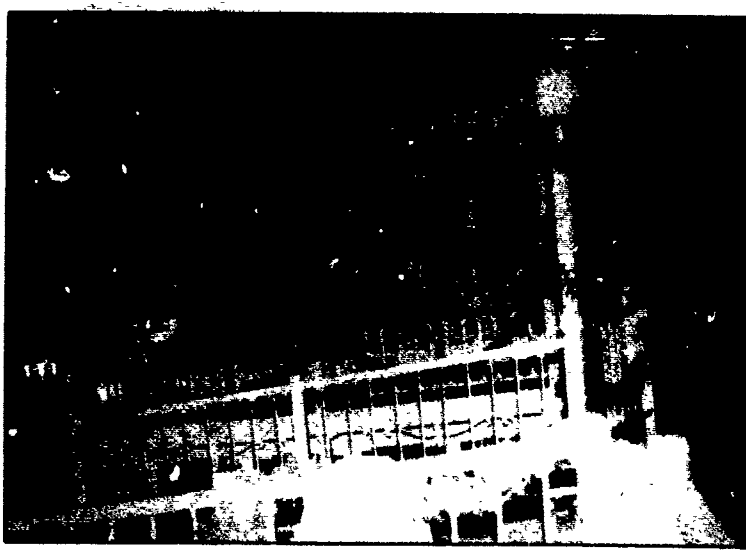
Corporate Suites

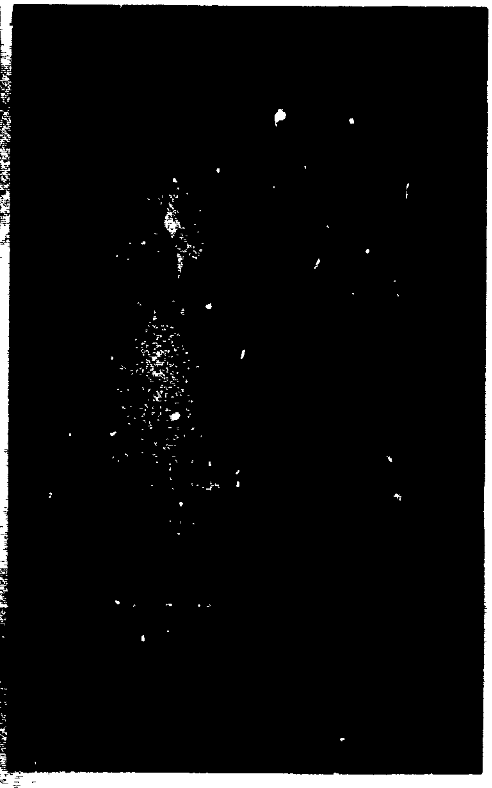


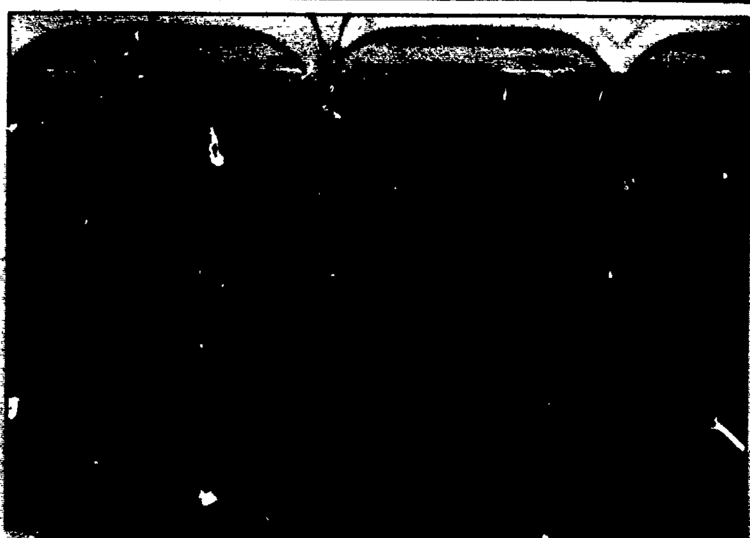




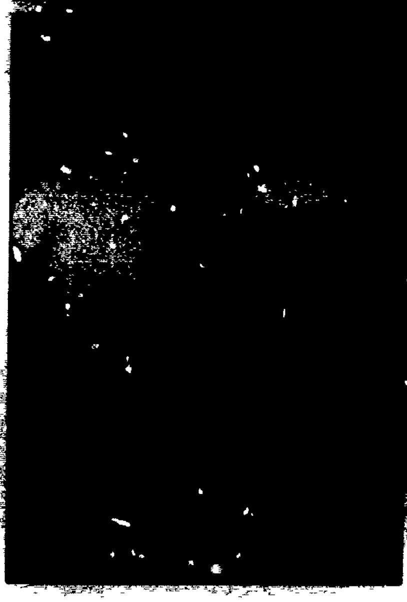
CAUSE88 Activities







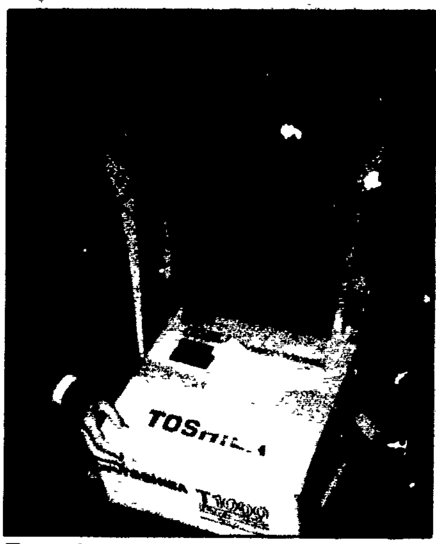
The General Jackson Riverboat provided a perfect setting for the CAUSE88 Welcome Reception—sponsored by Digital Equipment Corporation. "How will they top this in San Diego next year?" asked one reveler. "Hire the Queen Elizabeth II?"



CAUSE88 Activities

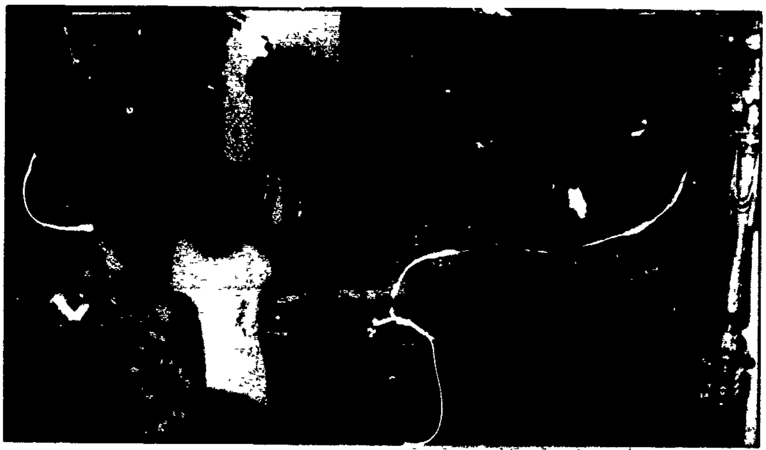
Information, of course, is what this conference is all about. The messaging kiosks which Apple Computer set up to help conferees exchange messages and get quick information about Nashville and the conference were a great success—as was the *Daily CHAT*, the first conference newsletter for CAUSE, which was sponsored by Apple Computer and Kinko's Academic Courseware Exchange.

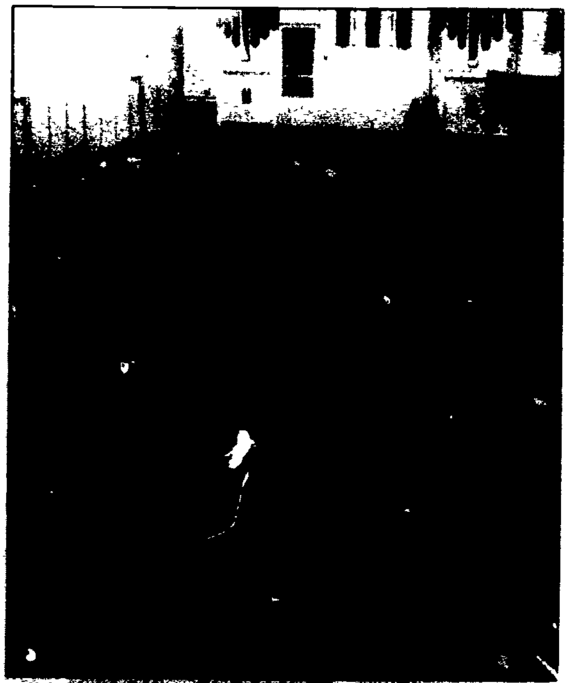
CAUSE88 Activities



Even breakfasts and lunches were informative, with the unveiling of big news from Digital, presentation of major awards sponsored by IA and SCT, corporate drawings, invitations to upcoming conferences, and recognition of the generous help of association members.

CAUSE88 Activities





Discussion sessions came in all sizes—from general sessions drawing most of the 950 registrants to the most informal of impromptu gatherings. Apple's HyperCard and desktop presentation workshops were popular events.

CAUSE88 Activities

Drawing conferees together for a final evening of talk, good food, and colorful entertainment was the Country Christmas Feast and Musical Revue sponsored by IBM. The Thursday evening gala is always a highlight of CAUSE national conferences—this one was outstanding for the professional quality of the singers and the liveliness and variety of action.